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Municipal Waste Combustion Study Characterization of the Municipal Waste Combustion Industry

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This report assesses future trends in MWC use by investigating current and projected levels of municipal waste generation. In projecting the need for new MWC facilities, attempts were made to define the probable configurations (including emission controls) and locations of future sources. The time frame for the characterization of trends in the MWC industry is generally the present through 1995, with limited data being available for the period to 2000.

Included in the analysis of potential MWC growth are:

- an assessment of the existing and predicted quantities of municipal waste generated nationally;
- an assessment of the impact of land disposal programs on MWC demand;
- an assessment of factors such as pending air emission or solid waste regulations affecting resource recovery of municipal wastes;
- a description of the existing MWC industry and its effect on future growth;
- an assessment of the number, design (including emission controls), and location of planned and projected MWC facilities;
- an assessment of increased capacity needs due to retirement of existing MWC facilities;
- a characterization of emission trends considering planned/projected MWC growth; and
- an examination of other factors such as tax incentives that may effect a shift towards or away from MWC as a disposal technique.

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MUNICIPAL WASTE COMBUSTION STUDY:

CHARACTERIZATION OF THE MUNICIPAL WASTE COMBUSTION INDUSTRY

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1. INTRODUCTION AND SUMMARY

This report presents the results of a recent study to describe the municipal waste combustion (MWC) industry and to characterize trends and growth in the industry. The information presented in this report was developed during a comprehensive, integrated study of municipal waste combustion. An overview of the findings of this study may be found in the Report to Congress on Municipal Waste Combustion (EPA/530-SW-87-021a). Other technical volumes issued as part of the Municipal Waste Combustion Study include:

- Emission Data Base for Municipal Waste Combustors (EPA/530-SW-87-021b)
- Combustion Control of Organic Emissions (EPA/530-SW-87-021c)
- Flue Gas Cleaning Technology (EPA/530-SW-87-021d)
- Cost of Flue Gas Cleaning Devices (EPA/530-SW-87-021e)
- Sampling and Analysis of Municipal Waste Combustors (EPA/530-SW-87-021f)
- Assessment of Health Risks Associated with Exposure to Municipal Waste Combustion Emissions (EPA/530-SW-87-021g)
- Recycling of Solid Waste (EPA/530-SW-87-021i)

In general, future trends in MWC use were assessed by investigating current and projected levels of municipal waste generation and the potential need for additional (beyond current level) MWC capacity and factors influencing a potential shift towards increased MWC use (e.g., declines in landfill sites and limitations in landfill use). In projecting the need for new MWC facilities, attempts were made to define the probable configurations (including emission controls) and locations of future sources. Future trends in air emissions from MWC facilities were qualitatively characterized according to the predicted trends in waste generation levels and new MWC facility number, types, sizes, and controls. The time frame for the

characterization of trends in the MWC industry is generally the present through 1995, with limited data being available for the period to 2000.

Included in the analysis of potential MWC growth are:

- an assessment of the existing and predicted quantities of municipal waste generated nationally (Section 2);
- an assessment of the impact of land disposal programs on MWC demand (Sections 2 and 8);
- an assessment of factors such as pending air emission or solid waste regulations affecting resource recovery of municipal wastes (Section 8);
- a description of the existing MWC industry and its effect on future growth (Section 3);
- an assessment of the number, design (including emission controls), and location of planned (Section 4) and projected (Section 5) MWC facilities;
- an assessment of increased capacity needs due to retirement of existing MWC facilities (Section 6);
- a characterization of emission trends considering planned/projected MWC growth (Section 7); and
- an examination of other factors such as tax incentives that may effect a shift towards or away from MWC as a disposal technique (Section 8).

Municipal waste is material discarded from residential, commercial, and some industrial establishments. The amount of waste generated in the year 2000 is expected to be in the range of 159 to 287 million tons per year, compared to estimates of current generation rates of 134 to 180 million tons. The most common method currently used to dispose of municipal waste is direct landfill. However, existing landfill capacity is being exhausted in many areas of the country and new landfills are becoming increasingly difficult to site. Because of these problems with direct landfill, increased emphasis will be made on reducing waste volume through combustion.

There are three basic types of facilities used to combust municipal waste. Combustion equipment is described in detail in the volume titled "Municipal Waste Combustion Study: Combustion Control of Organic Emissions;" EPA/530-SW-87-021c. The predominant type is called "mass burn" because the municipal waste is combusted without any preprocessing other than removal of items too large to go through the feed system. The combustors at mass burn facilities usually have overfeed stoker type grates. These combustors are field erected and individual combustors can range in size from 50 to 1000 tons per day of municipal waste input. A second type of facility is the modular combustor. Modular combustors are typically shop-fabricated and range in size from 5 to 100 tons per day. A third method for combusting municipal waste is processing it to produce refuse derived fuel (RDF), then combusting the RDF in a waterwall boiler. RDF offers the advantage of producing a more homogeneous fuel and increasing the percentage of municipal waste which is recycled.

Currently existing MWC facilities have a combined design capacity of 48,971 tons per day of municipal waste. Mass burn/overfeed stokers make up 68 percent of the existing capacity. The majority of existing facilities with mass burn/overfeed stoker combustors have a site capacity greater than 1000 tons per day and have 2 or more combustors. RDF facilities comprise 23 percent of the existing capacity. Modular combustors make up the remaining 9 percent of the existing capacity. The majority of the existing facilities are located in the New England and Mid-Atlantic States due to the dense populations and shortage of suitable landfill sites.

Facilities in the planning/construction stage represent a total capacity of 193,371 tons per day. As is the case with existing capacity, the majority of the planned facilities are mass burn with site capacities of over 1000 tons per day. Most of the planned facilities will also be located in the New England and Mid-Atlantic States. However, a considerable number will be located in California. Estimates of projected growth through the year 2000 indicate that the total capacity of MWC facilities will range from 113,000 to 255,000 tons per day of installed capacity.

Almost all existing facilities have some type of particulate matter emission controls. Many existing modular combustors attempt to control

particulate matter using a two-stage combustion process, though some of these facilities also have add-on controls. Other facilities use add-on controls, such as ESPs, dry scrubbers, wet scrubbers, and baghouses. Almost all new facilities will have add-on particulate controls such as ESPs and baghouses. In addition, a significant number may include acid gas controls. However, total emissions from MWC are still expected to increase due to the large increase in the total capacity of the population.

Though growth of MWC is expected to continue, there are several issues which may affect the growth rate. These issues include changes in tax laws, regulations regarding ash disposal, energy prices, air emission regulations, and public perception of risk due to MWC.

2. MUNICIPAL WASTE QUANTITIES, COMPOSITION, AND DISPOSAL METHODS

Municipal waste is material discarded from residential, commercial, and some industrial establishments. Included are such sources as private homes, apartment complexes, office buildings, retail stores, and industrial plants. This material is collected by either municipally-owned trucks or private haulers and transferred to a central point for disposal. Table 2-1 presents estimates of annual municipal waste generation for the years 1980 through 2000.

Based on these estimates, the amount of municipal waste potentially generated by the year 2000 will be in the range of 159 to 287 million tons per year. The values would represent increases beyond current levels of 25 to 73 million tons per year of total municipal waste generation.

Of the total amount of waste generated, approximately 75 to 90 percent is estimated to be actually collected and disposed of in a controlled way.[4] There are several reasons for waste collections being less than the total amount of waste generated. Waste is self-disposed in most rural areas and in many small towns. Some waste is littered. In some areas, due to climate or local practice, yard waste is not removed for disposal. Also, where food waste is disposed of by kitchen garbage disposal units, it ends up in the sewer rather than in municipal waste collection trucks. In addition, some bulky items in the waste, such as appliances and furniture, brush, street sweepings, and tires are delivered separately to landfills. Therefore, these wastes do not show up as waste collected in compactor trucks from homes or businesses.

Table 2-2 presents the weight percent composition of municipal waste disposed in 1980 and projected compositions for 1990 and 2000. No large percentage changes in waste composition are forecast. The heat content of municipal waste is projected to increase by approximately 2 percent. This is due to the slight increase in the percentage of paper and plastics, which provide the majority of the heat content of municipal waste.[6]

TABLE 2-1. QUANTITIES OF MUNICIPAL WASTE[a,b] GENERATED (10^6 TONS/YEAR)

Source	Year				
	1980	1985	1990	1995	2000
Midwest Research Institute[c]	159	180[d]	201	---	---
Frost and Sullivan[c]	---	214	238[d]	263[d]	287
Franklin Associates Ltd.[e]	126	134[d]	141	150	159

[a]References 1 through 3.

[b]Dashes indicate data not available.

[c]This source did not specify if materials recovered for recycling were included in the estimates shown.

[d]Linearly interpolated values.

[e]Does not include materials recovered for recycling.

TABLE 2-2. CURRENT AND FORECAST COMPOSITION OF DISPOSED RESIDENTIAL AND COMMERCIAL WASTE (WEIGHT PERCENT)[5]

Component	Year 1980	1990	2000
Paper and Paperboard	33.6	38.3	41.0
Yard Wastes	18.2	17.0	15.3
Food Wastes	9.2	7.7	6.8
Glass	11.3	8.8	7.6
Metals	10.3	9.4	9.0
Plastics	6.0	8.3	9.8
Wood	3.9	3.7	3.8
Textiles	2.3	2.2	2.2
Rubber and Leather	3.3	2.5	2.4
Miscellaneous	1.9	2.1	2.1
TOTAL	100.0	100.0	100.0

There are three alternatives for the disposal of collected municipal waste. These are direct landfill, combustion, and separation and recycle. Table 2-3 presents the relative amounts of solid waste disposed of by each method in 1984. Based on these estimates, 85 percent of the municipal waste collected is disposed of by direct landfill.

Though direct landfill is the most common method of municipal waste disposal, it is becoming less and less practical. For example, New Jersey closed over 58 percent of its operating landfills since 1977 as a result of reaching approved design capacity or because of State enforcement actions.[8] Only one new landfill has opened. New York City has closed 14 of its 17 refuse landfills over the past 20 years.[9] California, New Jersey, and Florida have all initiated programs to minimize the landfilling of waste.[10,11] In addition, the Resource Conservation and Recovery Act (RCRA) has made landfills more costly in some areas due to requirements for liners, leachate containment, monitoring, etc.

Due to the lack of suitable new landfill sites, increased landfill operating costs, and closing of existing sites, municipalities are seeking methods to reduce waste volume and extend landfill life. Combustion of municipal waste, which reduces the volume of material requiring landfill by 70 to 90 percent, is the waste disposal method currently receiving the most emphasis, and is expected to grow at a faster rate than municipal waste generation.[12] Prior to the 1970s, municipal waste combustion usually was practiced only to reduce waste volume, and no energy was recovered. The number of sites receiving energy from combustors was minimal. However, since 1970, most new MWC facilities have been designed to recover the energy content of the waste by producing steam and electricity. Almost all MWC facilities to be constructed in the future are expected to have energy recovery.[13,14]

TABLE 2-3. DISPOSITION OF MUNICIPAL WASTE IN 1984[a]

	MSW in 10^6 TPY
Total Generated	197.3
Uncollected[b]	49.3
Recovered and Recycled	15.0
Disposed of by Municipalities	
Combustion[c]	6.5
Direct Landfill[d]	126.5

[a]Based on data presented in Reference 7.

[b]Assumed to be 25 percent of total generation.

[c]Includes combustion with and without heat recovery.

[d]Calculated as the difference between total municipal waste generated, and amounts either uncollected, recycled, or combusted.

2.1 REFERENCES

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3. EXISTING MUNICIPAL WASTE COMBUSTION FACILITIES

Table 3-1 presents a summary of existing municipal waste combustion (MWC) facilities. The facilities are grouped by three design types: mass burn facilities, modular facilities, and facilities that produce and combust RDF. These design types are described in detail in the volume titled "Municipal Waste Combustion Study: Combustion Control of Organic Emissions;" EPA/530-SW-87-021c. A complete list of the facilities employing these designs is provided in Appendix A. Also shown in Appendix A are emission parameters for existing facilities used as inputs for the Human Exposure Model (HEM).

The population of municipal waste combustors in the United States (both existing and projected) is described in terms of 1.) throughput or capacity, 2.) number of facilities or sites, 3.) type of combustor, and 4.) location of facilities. Throughput or capacity may be aggregated in several ways: by type of combustor, by number of facilities in a state or region of the United States, or by facility or unit. A facility may consist of one or more combustors. Capacity refers to the amount of municipal waste a facility, unit, or group of facilities is design to combust.

Table 3-1 presents a summary of the existing MWC facility population. The total design capacity for the 111 existing MWC facilities is 48,971 tons per day of municipal waste input. Based on a capacity utilization of 80 percent, the actual municipal waste throughput is estimated to be 39,177 tons per day. Table 3-2 and Figure 3-1 show the distribution of design capacity among the three design types. The mass burn facilities have the largest share of the installed capacity, 68 percent of the total. The RDF facilities represent 23 percent of the total capacity and modular facilities represent 9 percent. Though they represent a small amount of the installed capacity, the number of modular facilities is greater than the number of mass burn facilities. There are only 10 RDF facilities.

Table 3-1 also groups the MWC facilities by design capacity. The majority of the facilities with modular combustors have design capacities of less than 250 tons per day. The majority of the capacity of mass burn

TABLE 3-1. SUMMARY OF EXISTING MWC FACILITIES[a]

FACILITIES WITH HEAT RECOVERY

Design Type	Design Capacity Range (TPD)	Number of Installed Facilities	Total Installed Capacity (TPD)	Emission Control Device[b,c]					Location				
				ESP	Baghouse	Wet Scrubber	Cyclone	EGB	New England and Mid-Atlantic	North Central	South Atlantic	South Central	Mountain and Pacific
Mass Burn	<250	8	1,291	7	1	0	0	0	1	1	5	1	0
Modular Combustor		37	3,292	7	3	4	2	1	9	5	4	14	5
RDF		1	200	1	0	0	0	0	0	1	0	0	0
Mass Burn	250 to <500	4	1,820	4	0	0	0	0	2	0	1	0	1
Modular Combustor		2	570	2	0	0	0	0	0	0	1	1	0
RDF		3	1,100	2	0	1	0	0	0	2	1	0	0
Mass Burn	500 to <1000	4	2,740	3	1[d]	0	0	0	1	0	0	2	1
Modular Combustor		0	0	0	0	0	0	0	0	0	0	0	0
RDF		1	600	1	0	0	0	0	1	0	0	0	0
Mass Burn	≥1000	8	14,250	8	0	0	0	0	4	1	3	0	0
Modular Combustor		0	0	0	0	0	0	0	0	0	0	0	0
RDF		5	9,500	5	0	0	0	0	2	2	1	0	0
TOTAL		73	35,363	40	5	5	2	1	20	12	16	18	7

TABLE 3-1. SUMMARY OF EXISTING MWC FACILITIES[a] (Continued)

FACILITIES WITHOUT HEAT RECOVERY

Design Type	Design Capacity Range (TPD)	Number of Installed Facilities	Total Installed Capacity (TPD)	Emission Control Device[b,c]					Location				
				ESP	Baghouse	Wet Scrubber	Cyclone	EGB	New England and Mid-Atlantic	North Central	South Atlantic	South Central	Mountain and Pacific
Mass Burn	<250	4	748	1	0	3	0	0	1	2	0	1	0
Modular Combustor		17	610	1	0	0	0	0	11	1	1	4	0
RDF		0	0	0	0	0	0	0	0	0	0	0	0
Mass Burn	250 to <500	2	900	0	0	2	0	0	1	1	0	0	0
Modular Combustor		0	0	0	0	0	0	0	0	0	0	0	0
RDF		0	0	0	0	0	0	0	0	0	0	0	0
Mass Burn	500 to <1000	11	7,150	7	1[d]	3	0	0	5	5	0	0	1
Modular Combustor		0	0	0	0	0	0	0	0	0	0	0	0
RDF		0	0	0	0	0	0	0	0	0	0	0	0
Mass Burn	≥1000	4	4,200	3	0	1	0	0	1	0	2	1	0
Modular Combustor		0	0	0	0	0	0	0	0	0	0	0	0
RDF		0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		38	13,608	12	1	9	0	0	19	9	3	6	1

[a]Based on data from a telephone survey of MWC facilities and data in References 1 through 19. Includes facilities expected to be operational as of the end of 1986.

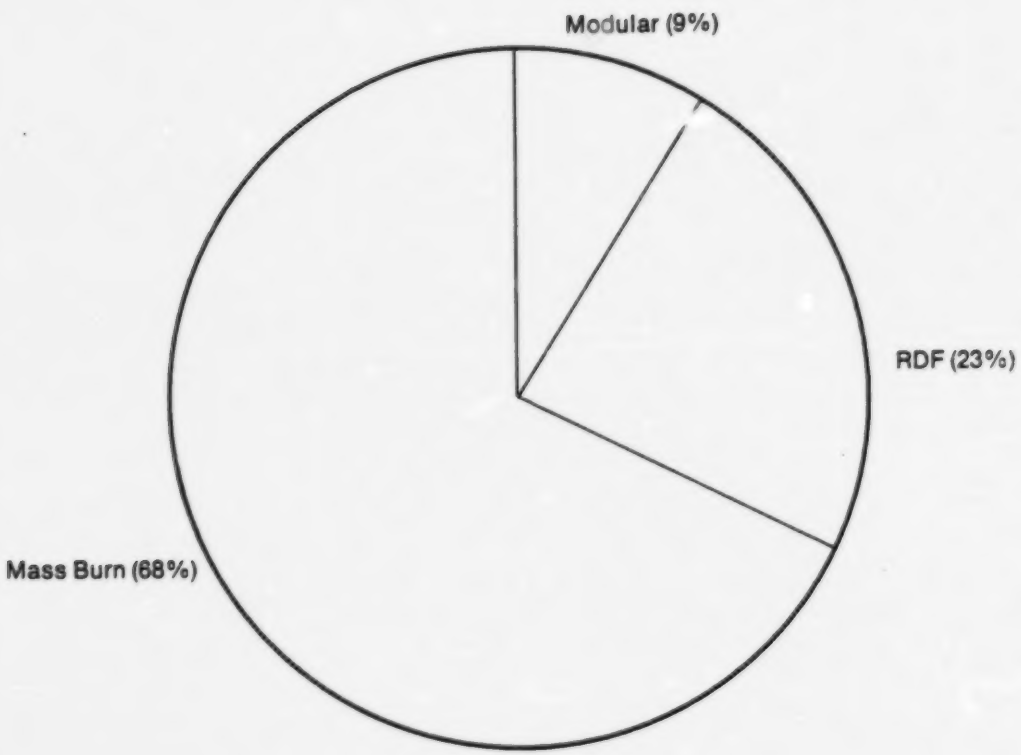
[b]Thirty-six facilities with modular combustors reported no add-on controls. Therefore, the total number of control devices shown is less than the total number of installed facilities.

[c]EGB = Electrostatic Gravel Bed filter. The wet scrubbers shown are installed for particulate control. The majority of these scrubbers are believed to be the venturi type. The effectiveness of wet scrubbers on acid gas emissions was not reported.

[d]This facility also has a dry scrubber for acid gas control upstream of the baghouse.

TABLE 3-2. EXISTING MWC FACILITIES BY DESIGN TYPE

Design Type	Installed Design Capacity, TPD	Number of Facilities
MASS BURN		
With Heat Recovery	20,101	24
Without Heat Recovery	12,998	21
Total	33,099	45
MODULAR COMBUSTOR		
With Heat Recovery	3,862	39
Without Heat Recovery	610	17
Total	4,472	56
RDF		
With Heat Recovery	11,400	10
Without Heat Recovery	0	0
Total	11,400	10
GRAND TOTAL	48,971	111



Total Design Capacity = 49,000 tons per day

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Figure 3-1. Distribution of Existing Installed Municipal Waste Combustion Capacity by Design Type

facilities is in the greater than 1000 tons per day size range. However, there is significant capacity within the 250 to 1000 tons per day range. Each MWC facility typically has two or more combustors. The data indicate that mass burn combustors are designed to meet a variety of capacity requirements, unlike the modular combustors which are specifically designed for a smaller combustion demand. Five of the 10 RDF facilities are designed to process more than 1000 tons per day of municipal waste.

Figures 3-2 and 3-3 show the distribution of MWC facilities by regions in the United States. A significant number, 39 of the 111 existing facilities, are located in the New England and Mid-Atlantic States. This is due to the dense population and relatively small land areas of these States which results in greater municipal waste generation and a shortage of suitable landfill sites. The Mountain and Pacific States have the least number of facilities of any region with a total of 8 existing facilities.

Table 3-1 shows that 73 of the 111 facilities, approximately two-thirds, have heat recovery in the form of steam generation. The steam produced by these facilities is either used to produce electricity, sold to an industrial or municipal user, or both.

The predominant form of emissions control at MWC facilities is an ESP. Fifty-two facilities have ESPs installed to control particulate matter emissions. Two facilities have dry scrubbers to control acid gas, followed by a baghouse to control particulates. Four facilities use baghouses alone. Fourteen facilities have wet scrubber systems to control particulates. Thirty-six facilities with modular combustors did not report any form of add-on emission controls.

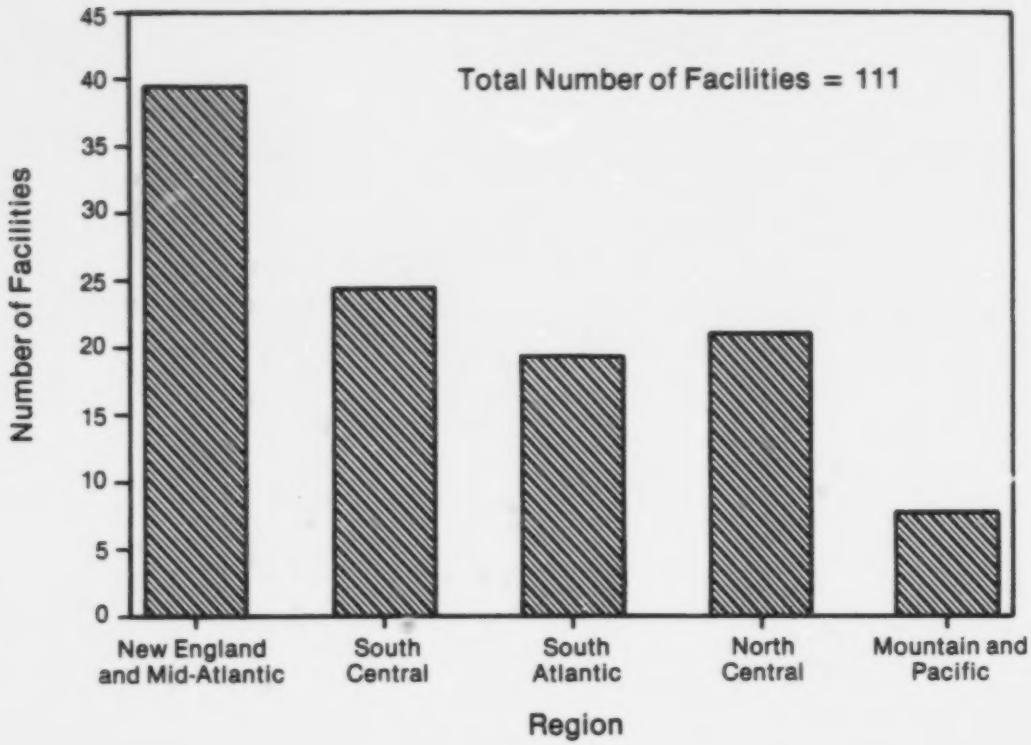

Figure 3 - 2. Distribution of Existing MWC Facilities by Region

Figure 3-3. Regional Distribution of Existing Municipal Waste Combustion Facilities

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4. PLANNED MUNICIPAL WASTE COMBUSTION FACILITIES

This section contains a description of planned MWC facilities. Some of these facilities have only been proposed, while others are in the advanced planning/construction phase. A complete list of these individual facilities is contained in Appendix B.

Planned facilities are facilities which are not yet operating, but are either actually under construction, have contracts for their construction under negotiation or signed, or have been formally proposed. The national growth projections, which are presented in Section 5, differ from the projections shown here in that some of the growth estimates presented in Section 5 are based on estimates of municipal waste growth or market surveys, and are not based on actual facilities known to be planned.

Tables 4-1 and 4-2 present a summary of planned facilities. They are grouped by the same design types that were used to group the existing facilities discussed in the previous section. There are 210 facilities shown in the planning/construction stage. One hundred and eighteen are mass burn facilities, 24 are facilities with modular combustors, and 31 are RDF facilities. For 37 facilities, data on the design type was either unavailable, or a design type had not been decided on. The total design capacity for these facilities is projected to be 193,371 tons per day, or approximately four times the total design capacity of the existing MWC facilities. The projected startup dates for the 127 facilities for which data are available range from 1986 to 1993.

Figure 4-1 shows, for planned facilities, the distribution of design capacity among the three primary design types. The mass burn facilities account for 59 percent of the total design capacity. The RDF facilities account for 20 percent, and the facilities with modular combustors account for only 3 percent. The remaining 18 percent is represented by facilities where the design technology is either undecided or not available. All of the planned facilities are expected to have energy recovery.

TABLE 4-1. SUMMARY OF PLANNED MWC FACILITIES[a]

Design Type	Design Capacity Range (TPD)	Total Design Capacity (TPD)	Planned Facilities	Number of Facilities by Location				
				New England and Mid-Atlantic	North Central	South Atlantic	South Central	Mountain and Pacific
Mass Burn[b]	<250	3,055	18	9	2	2	1	4
Modular Combustor[c]		1,377	14	7	3	0	2	2
RDF		450	3	1	1	0	0	1
UDT[d]		1,225	7	3	2	0	1	1
Mass Burn	250 to <500	6,155	17	7	2	3	0	5
Modular Combustor		3,730	10	6	0	1	0	3
RDF		730	2	2	0	0	0	0
UDT		3,220	9	3	2	2	0	2
Mass Burn	500 to <1000	21,653	33	17	2	4	3	7
Modular Combustor		0	0	0	0	0	0	0
RDF		8,544	11	3	2	2	0	4
UDT		3,700	6	3	0	1	2	0
Mass Burn	≥1000	82,532	50	25	2	6	1	16
Modular Combustor		0	0	0	0	0	0	0
RDF		29,150	15	2	2	3	0	8
UDT		27,850	15	8	0	3	1	3
TOTAL		193,371	210	96	20	27	11	56

[a]Based on data in References 1 through 43.
[b]Includes both overfeed stoker and rotary combustor designs.
[c]Includes both starved air and excess air designs.
[d]Design type has either not been specified or data on design type was not provided in the references.

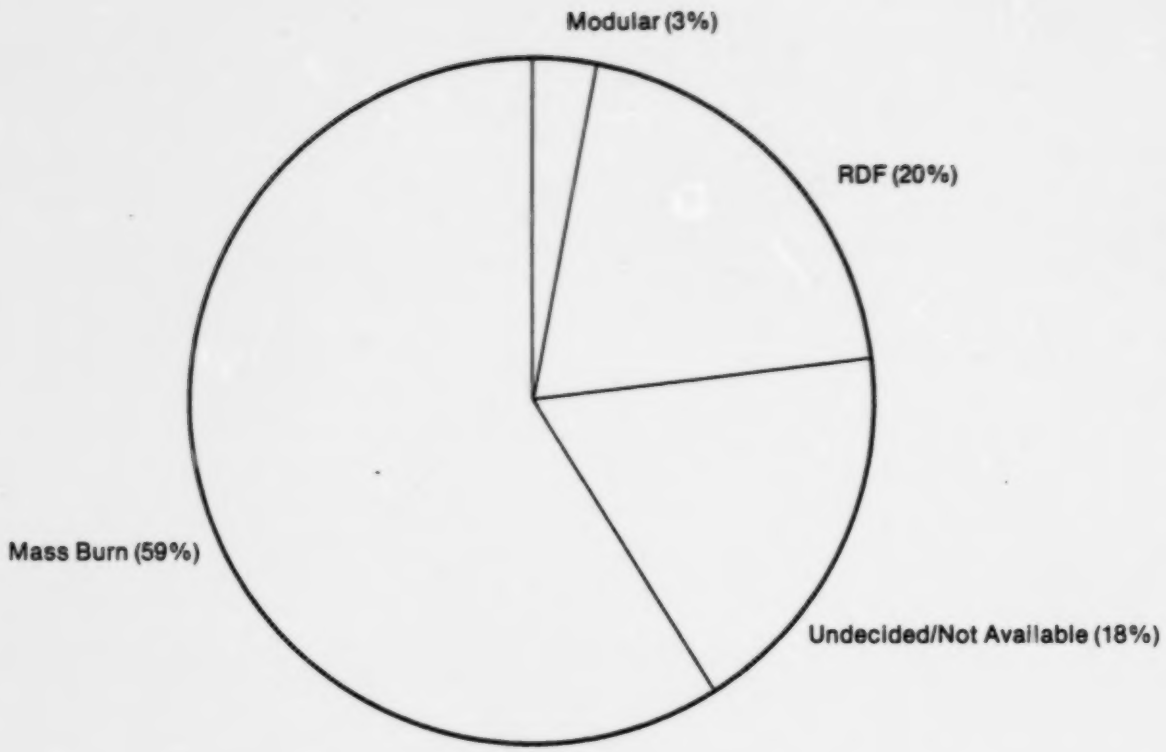
TABLE 4-2. SUMMARY OF PLANNED MWC FACILITIES BY DESIGN TYPE

Design Type	TPD	Number of Facilities
Mass Burn[a]	113,395	118
Modular Combustor[b]	5,107	24
RDF	38,874	31
UDT[c]	35,995	37
TOTAL	193,371	210

[a]Includes both overfeed stoker and rotary combustor designs.

[b]Includes both starved air and excess air designs.

[c]Design type has either not been specified or data on design type was not provided in the references.



Total Design Capacity = 190,000 tons per day

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Figure 4-1. Distribution of Planned Municipal Waste Combustion Capacity by Design Type

Figure 4-2 shows the regional distribution of planned MWCs. The majority of facilities are planned for the Northeastern States and California. Table 4-3 presents the projected capacity growth for the nine States whose planned growth exceeds 5000 TPD. The reason that these States have significant growth is because these are the areas where direct landfill is most expensive, and/or the State and local governments are undertaking ambitious programs to minimize landfilling. California is projected to have the greatest growth in new MWC facilities. This State has a dense population in the coastal areas, is actively working to minimize landfilling, and also has very little combustion capacity presently installed.

Information on the type(s) of emission control devices to be used in planned facilities was available for some of the facilities shown in Table 4-1. Based on this data and discussions with combustor/boiler manufacturers, all new municipal waste combustion facilities can be predicted to have either ESPs or baghouses for particulate matter control.[30-33] In addition, many of these planned facilities will include dry scrubbers for acid gas control in response to State and local environmental regulations. The decision on whether or not to require acid gas control is made on a case-by-case basis. States which are reportedly requiring acid gas controls as a general rule include California, Michigan, New Jersey, Connecticut, Massachusetts, Oregon, Washington, and Maine.[44-48] Florida is considering requiring acid gas control.[45] Each of these States are ones where significant new MWC capacity is planned. Therefore, a significant portion of new MWC facilities will likely have acid gas controls installed. In addition, the South Coast Air Quality Management District in California reportedly plans to require thermal de-NO_x on new MWC facilities in the South Coast area.[47]

Figure 4 - 2. Regional Distribution of Planned MWC Facilities

TABLE 4-3. STATES WITH PLANNED GROWTH IN MWC CAPACITY EXCEEDING 5000 TPD

State	Number of Facilities	Planned Capacity (TPD)[a]
California	36	42,522
New Jersey	6	23,955
New York	23	22,853
Pennsylvania	26	18,472
Florida	13	14,420
Massachusetts	11	10,060
Connecticut	11	8,520
Virginia	4	8,375
Washington	5	5,150
Subtotal	149	154,327
Remaining States	61	39,044
Total	210	193,371

[a]Ranked in descending order by capacity.

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5. PROJECTED GROWTH OF MUNICIPAL WASTE COMBUSTION THROUGH 2000

This section presents the projected growth of the MWC industry through the year 2000. The projections shown are based on market surveys, projections in the growth of municipal waste generation, and the data on planned facilities shown in Section 4.

Total projected growth of MWC through the year 2000 is shown in Table 5-1. The values shown represent the total populations of MWC facilities, including existing facilities (discussed in Section 3) and planned facilities (Section 4) expected to begin operation in 1986 through 2000.

As the table shows, there is considerable variability among the growth estimates generated by various sources. However, all the estimates indicate a significant growth of municipal waste combustion through the year 2000. Based on the list of facilities currently shown in Appendices A and B, the capacity of municipal waste combustion facilities will reach 242,342 tons per day of installed capacity by the time all the facilities currently in the planning stage with startup dates prior to 1991 are on-line. The projected startup dates for the facilities in Appendix B range from 1986 through 1993 and actual startup dates are not available for some facilities. In addition, there is considerable uncertainity in the available startup dates, and past experience has shown that startup delays of up to several years are common. Based on this, the population estimate of 242,342 tons per day would most likely occur sometime in the 1990s.

Table 5-2 presents projections for the percentage by region of the total throughput for MWC facilities based on projections by Franklin Associates. This forecast does not include existing facilities which combust municipal waste without energy recovery. However, including these facilities would not significantly affect the results. As shown in Table 5-2, the regions with the largest amount of MWC are currently the New England and Mid-Atlantic States. These regions are expected to continue to account for 45 percent of national municipal waste combustion through the

TABLE 5-1. ESTIMATED INSTALLED CAPACITY OF MUNICIPAL WASTE COMBUSTION FACILITIES

Source	Type of Facilities[a]	Year 1985 Number	1985 Capacity	1990 Number	1990 Capacity	1995 Number	1995 Capacity	2000 Number	2000 Capacity
Franklin Associates[b,c]	MB	---	---	---	51,205	---	67,855	---	84,505
	MI	---	---	---	2,653	---	18,286	---	4,503
	RDF	---	---	---	12,736	---	3,578	---	23,836
	TOTAL	---	---	---	66,594	---	89,719	---	112,844
Frost and Sullivan[b]	MB	40	27,566	---	70,781	---	113,999	105	157,216
	MI	47	3,697	---	8,681	---	13,664	167	18,647
	RDF	18	17,830	---	38,330	---	58,830	43	79,330
	TOTAL	105	49,093	---	117,792	---	186,493	315	255,193
Appendices A and B[d,e]	MB	39	29,399	163	146,494	---	---	---	---
	MI	46	3,521	80	9,579	---	---	---	---
	RDF	9	10,660	41	50,274	---	---	---	---
	UDT	0	0	37	35,995	---	---	---	---
	TOTAL	94	43,580	321	242,342	---	---	---	---

[a] MB = mass burn
MI = modular combustor
RDF = refuse derived fuel
UDT = either technology is undetermined at this time or data not available

[b] The data from these sources (References 1 and 2) includes only facilities with energy recovery. The values for installed capacity of MWC facilities without energy recovery shown in Table 3-2 were added to the values for facilities with energy recovery in this source to determine the total MWC facility population.

[c] Data from this source are in terms of municipal waste throughput for all types of facilities. An 80 percent capacity factor was assumed to calculate facility capacities.

[d] The 1985 capacity estimates and number of facilities does not exactly match the totals for existing facilities listed in Section 3.0 because several facilities began operating in 1986.

[e] The actual startup dates were not available for almost half of the facilities in Appendix B. It was assumed that all plants without startup dates will be in operation by 1990. It is possible that some of these plants may not start up until after 1990 or may be scrapped. Therefore, the 1990 population estimate may be somewhat overstated. Facilities with established startup dates beyond 1990 are not included in the totals shown here.

TABLE 5-2. PERCENTAGE BY REGION OF THE FORECAST WASTE TO ENERGY THROUGHPUT 1985 TO 2000[1]

Region	Throughput, Percent of Total		
	1985	1990	2000
New England and Mid-Atlantic	45	45	45
North Central	19	13	13
South Atlantic	28	21	20
South Central	7	6	7
Mountain and Pacific	1	15	14

year 2000. The regions experiencing the greatest growth are the Mountain and Pacific regions. Most of the growth will be in California.

Based on the data on estimated capacities in Appendix B and Frost and Sullivan projections, mass burn facilities are expected to account for between 60 and 70 percent of the total projected capacity by the year 2000. Facilities that combust RDF will constitute between 20 and 30 percent, and facilities with modular combustors will account for approximately 10 percent of the total projected capacity by the year 2000. Though modular systems will make up the smallest segment of the installed capacity, they will make up the majority of the number of plants due to their small size.

No detailed data are available on the size distribution of plants projected through the year 2000. Data on plants in the planning and construction stage shown in Section 4 indicate that plants over 1000 tons per day in size will make almost half of the new capacity added through 1993. However, facility manufacturers indicated that more plants will begin to be built in the 500-1000 tons per day size.[3,4] This is because the number of cities which generate enough waste to require over 1000 tons per day plants is limited.

There are also no detailed data on the types of emission controls these new facilities will have. Most manufacturers contacted stated that new facilities will have ESPs for particulate control unless local regulations require baghouses.[3-6] As previously mentioned, States are also requiring acid gas controls on a case-by-case basis. As a general rule California, New Jersey, Massachusetts, Florida, Michigan, Washington, Oregon and Maine either have or will likely require acid gas controls for future facilities. Since these States are also areas where large portions of the new facilities are projected to be built, a significant portion of the new facilities built may have acid gas controls in addition to highly efficient particulate matter controls such as ESPs and baghouses.

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6. RETIREMENT OF EXISTING FACILITIES

The net growth of the municipal waste combustion industry will be the difference between the growth in capacity due to construction of new facilities, and retirement of existing facilities. This section discusses projected facility retirement.

Table 6-1 presents a list of existing facilities that are currently believed to be shut down. All these facilities are believed to have been operational at some time in the 1980s. Two of the facilities shown are under design review and may potentially reopen. Not shown in Table 6-1 are RDF processing facilities which were producing fuel for use by utilities off site. There were approximately eight facilities of this type which were operating in the early 1980s but are now shut down.[1-5]

The number of facilities retired in the next 15 years is expected to be small. The majority of the existing facilities shown in Appendix A were built since 1970, and will only be 30 years old in the year 2000. In addition, it appears that where possible, existing facilities will be rebuilt rather than permanently retired. For example, the Oceanside, New York plant was originally commissioned in 1965 but extensively rebuilt in 1974-1977.[6] The facility is closed now, but is under consideration for another possible renovation.[7] Some of the older facilities were shut down in the 1970s due to the Clean Air Act. The Clean Air Act required that many existing facilities add emission controls. This resulted in the shut down of some plants.[8] All the existing mass burn/overfeed stoker type plants (which represent most of the existing capacity) now have reasonably efficient emission controls installed.

TABLE 6-1. MUNICIPAL WASTE COMBUSTION FACILITIES CURRENTLY SHUT DOWN[a]

Location	Type[b]	Design Capacity, TPD	Shut Down Date	Future Status
Sullivan Springs, AR	MI	16	NA	Unknown
Huntsville, AL	MI	50	1985	Shut down due to conveyer problems
Crossville, TN	MI	60	NA	Unknown
Genessee Township, MN	MI	100	NA	Unknown
Ansonia, CT	MB/OF	150	1984	Municipal Waste is sent to Windham, CT
Braintree, MA	MB/OF	384	1983	Permanently shutdown
Oyster Bay, NY	MB/OF	500	NA	Unknown
Oceanside, NY	MB/OF	750	NA	New incinerators ordered, negotiating redevelopment of project
Merrick, NY	MB/OF	NA	NA	Unknown
Monroe County, NY	RDF/D	2000	1984	Currently preparing RFP for alternative use.
Hempstead, NY	RDF/D	2000	1981	Unknown

[a]Based on data from References 1-5 and the list of currently operating facilities presented in Appendix A.

[b]RDF/D - refuse derived fuel fired in a dedicated boiler on-site.
MI - modular combustor.
MB/OF - mass burn facility with overfeed stoker incinerator/boiler.

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7. EMISSION TRENDS

Based on the data presented in Sections 3 through 6, it appears that emissions from municipal waste combustion will steadily increase between 1985 and 2000. This increase will be due to the significant new capacity expected, and lack of retirements of existing facilities. Insufficient data are available to exactly quantify the amount of the increase. However, some trends can be estimated.

Particulate emissions will likely increase the least (as a percentage of existing emissions). This is because all new mass burn and RDF facilities, and most of the new modular facilities, will be equipped with highly efficient particulate control devices such as ESPs and baghouses. Most existing mass burn and RDF facilities have also installed these types of controls. Since emission levels of some metals tend to parallel total particulate, the emissions of metals will tend to follow the trend of total particulate.

Acid gas emissions (HCl, HF, H_2SO_4) will also increase. Many new facilities, especially those in States with the highest growth rates, will have acid gas controls. However, the use of acid gas controls will be less common nationwide than the use of particulate controls. Only two existing facilities currently have acid gas controls. Therefore, considerable potential for acid gas emission reductions exists for facilities currently operating. No States are currently known to be considering requiring retrofit of acid gas controls.

Emissions of organic compounds would be expected to increase in the absence of regulation. None of the planned or existing facilities have controls specifically for organic emissions. However, emission tests at facilities in Canada and West Germany indicate that the dry scrubber/baghouse system being required in many areas for acid gas control is also effective in reducing organic emissions.[1,2] Also, new combustors are expected to achieve more efficient combustion, so that organic emissions would be expected to be lower than organic emissions from existing facilities.

7.1 REFERENCES

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8. ISSUES AFFECTING GROWTH

There are many issues which could potentially affect the growth of MWC. These issues have been divided into four general categories for discussion in this section. These categories are: air emission regulations, land disposal regulations and programs, materials separation and recycling, and other issues such as tax law changes, energy prices, and public resistance to the location of resource recovery facilities near residential areas.

8.1 AIR EMISSION REGULATIONS AND CONTROL STRATEGIES*

The air emission regulations for MWC may affect the growth of the industry because as emission regulations become more stringent the cost of controlling the emissions increases. Depending on the level of increased control costs, the competitive balance of MWC versus direct landfill or materials recycle could be affected.

Regulatory strategies established in the U.S. to control emissions to air from MWC facilities exist at both the Federal and State level. Prior to promulgation of the New Source Performance Standard (NSPS) for incinerators (40 CFR Part 60 Subpart E) in 1971, uncontrolled particulate emissions from combustion of refuse were on the order of 1.0 grains/dscf at 12 percent CO_2.[1] However, Federal and local regulations now require control devices with increased collection efficiencies compared to the mechanical settling chambers used to control emissions from combustors prior to NSPS.

Today, all States require the control of particulate emissions and opacity in their State implementation plan (SIP) requirements for municipal waste combustors. In addition, the States with the highest growth rates of combustion facilities tend to also require control of a variety of

*This information was originally collected in mid-1986. Some of this information may be out of date due to recent changes in regulations.

other pollutants through the use of add-on controls and, in some cases, furnace operating requirements. Foreign countries such as West Germany and Japan have also set emission limits for a variety of other criteria and noncriteria pollutants. Limits have been established for pollutant emissions from municipal waste combustors in both the U.S. and abroad for following: particulate matter; acid gases such as sulfuric, HCl, and HF; nitrogen oxides; carbon monoxide; total hydrocarbons; and various other pollutants, such as CDD/CDF and metals. The discussion of regulations in this section will focus on these pollutant categories.

Both State and Federal regulations affecting operation of municipal waste combustors are presented in this section. Included in this section is comparison of the NSPS and best available control technology/lowest achievable emission rate (BACT/LAER) determinations for facilities that have been permitted in the last few years. The regulatory strategies listed in the SIPs will also be discussed and compared to the Federal NSPS regulation.

The control of noncriteria air pollutants has become a major concern in the U.S. in the past few years. At the Federal level, national emission standards for hazardous air pollutants (NESHAP) have been established for seven pollutants including beryllium emissions from incineration of wastes containing beryllium. The role of NESHAPs in reducing emissions from municipal waste combustors will be described. The role of State programs for control of noncriteria pollutants and their possible future importance to regulations will also be discussed. Finally, the current regulatory status of municipal waste combustion in a few foreign countries will be reviewed.

8.1.1 Federal Regulations and Programs

New Source Performance Standards

The NSPS for municipal waste combustors regulates combustors burning at least 50 percent municipal waste and having a design capacity of 50 tons/day or greater. The standard, as promulgated under Subpart E of 40 CFR 60, set the limit of particulate matter that can be discharged to the atmosphere at

0.08 gr/dscf corrected to 12 percent CO_2. (This is about equivalent to 0.18 lb/10^6 Btu.)* This standard applies to those facilities that were under construction or in the process of modification as of August 17, 1971. Existing facilities that undergo modification and increase the amount of particulate matter emitted are also subject to this NSPS. Tests at two domestic and two European combustors equipped with ESPs to control particulate matter were performed to establish the value of the NSPS. The particulate emissions from these tests ranged from 0.07 to 0.09 gr/dscf corrected to 12 percent CO_2 at the U.S. municipal waste facilities and 0.05 to 0.07 gr/dscf corrected to 12 percent CO_2 at the European facilities.

In addition, the NSPS for industrial, institutional, and commercial steam generating units (40 CFR 60, Subpart Db) would apply to municipal waste combustors that produce steam and that have a heat input capacity of more than 100 million Btu/hour. The particulate emission limit for those combustors is 0.1 lb/10^6 Btu(0.046 gr/dscf corrected to 12 percent CO_2). The level of 0.1 lb/10^6 Btu was based on tests at four steam generating units ranging in heat input capacity from 47 to 290 million Btu/hour which fire municipal waste. All units were controlled by ESPs. The emission levels measured at these facilities ranged from 0.2 to 0.05 lb/10^6 Btu and indicated that properly designed ESPs can reduce particulate emissions from these units to levels below 0.10 lb/10^6 Btu.

Prevention or Significant Deterioration Requirements

In addition to NSPS, prevention of significant deterioration (PSD) provisions were established in the Clean Air Act for stationary sources of air pollution to maintain clean air and yet allow new industrial growth. The PSD applies only to construction or modification of major sources (as defined in PSD regulations) in attainment or unclassifiable areas as defined under Section 107 of the Clean Air Act for any criteria pollutant. New sources that locate in areas designated nonattainment do not require a

*Conversions from gr/dscf to lb/10^6 Btu assume a municipal waste feed higher heating value of 4500 Btu per pound, and an F-factor of 10,003 dscf/million Btu.

permit but must be reviewed in accordance with nonattainment provisions in SIP. In some cases, a source may be located in an area designated under the Clean Air Act as nonattainment for one pollutant and attainment for another. Therefore, the source would be subject to PSD review for that one pollutant and nonattainment provisions for the other pollutant.

Municipal waste combustors capable of charging more than 250 tons per day of refuse are one of 28 named PSD source categories. Therefore, any municipal waste combustion facility meeting this criterion is a major source. A municipal waste combustor can also be considered a major source if it emits 100 tons per year or more of any pollutant regulated by the Clean Air Act.

The PSD regulations required that, for new major stationary sources, best available control technology (BACT) will be required for each regulated pollutant emitted in excess of minimum specified levels. BACT is also required for major modifications to existing stationary sources for each regulated pollutant emitted for which there is a significant net emission increase.

The BACT requirements are reviewed at the State level on a case-by-case basis for each source seeking a permit. Table 8-1 summarizes BACT requirements established by States in which new MWC facilities were constructed between the years 1981 and mid-1984. The data are presented by EPA region, and a mean and standard deviation value are listed for each pollutant for the total number of new MWC facilities permitted in a specific region. It is primarily PM emissions that have been subject to BACT at these facilities. However, BACT emission rates have also been established at numerous facilities for sulfur dioxide, nitrogen dioxide, carbon monoxide and volatile organic compounds (VOC). The mean BACT rates for PM at the 22 facilities listed in the table range from a low of 0.015 to 0.043 gr/dscf, or approximately 20 to 50 percent of the current NSPS emission limit (40 CFR 60, Subpart E). States in three of the five EPA regions listed in the table also regulate other pollutants.

TABLE 8-1. MEAN BACT EMISSION RATES FOR COMBUSTORS BURNING SOLID WASTE WHICH IS AT LEAST 50 PERCENT MUNICIPAL[a]

Region[a]	Number	Particulate Matter Mean BACT Rate (gr/dscf)	Sulfur Dioxide Mean BACT Rate (lb/Ton)[b]	Nitrogen Oxides Mean BACT Rate (lb/Ton)[b]	Carbon Monoxide Mean BACT Rate (lb/Ton)[b]	Volatile Organic Compound Mean BACT Rate (lb/Ton)[b]
Region I	9	.043 ± .013	2.63 ± 1.14	3.28 ± 1.73	18.5 ± 14.2	.934 ± .894
Region II	3	.030 ± .000	c	3.00 ± 0.00	.620 ± .000	c
Region III	3	.015 ± .000	c	c	c	c
Region IV	4	.038 ± .014	c	c	c	c
Region X	3	.015 ± .000	c	c	c	c
Nationwide		.033 ± .015	2.63 ± 1.14	3.21 ± 1.48	14.0 ± 14.5	.934 ± .894
Total Number		22	9	12	12	9

[a]Regions omitted did not issue a PSD permit for any incinerators between 1981 and mid-1984.

[b]Units are pounds of pollutant emitted per ton of municipal waste burned.

[c]No specified BACT rates for this pollutant.

SIP Requirements for Nonattainment Areas

New sources may be subject to nonattainment review for certain pollutants if they are seeking to locate in nonattainment areas. Nonattainment areas are areas that do not meet National Ambient Air Quality Standards. Of special relevance to municipal waste combustors are those areas designated nonattainment for particulate matter and VOC. In nonattainment areas, LAER technology review is required. The LAER technology emission rate is defined as either the most stringent emission limitation in SIPs for any class or category of sources or the most stringent emission rate achieved in practice, whichever is more stringent.

Data are available for one facility, located in EPA Region I, which was permitted in a nonattainment area during the period 1977 through 1981. The facility had a design capacity of 960 tons per day. The LAER established for this facility was 0.03 gr/dsf for particulate matter and 7.99 lb/hr (0.2 lb/ton of waste) for VOC. Comparing these limits with the data in Table 8-1 shows that they are toward the lower end of the ranges for both particulate matter and VOC. However, based on this one example it does not appear that LAER produces a distinguishable level of stringency over BACT.

National Emission Standards for the Hazardous Air Pollutants

Of the 12 National Emission Standards for Hazardous Air Pollutants (NESHAPs) promulgated pursuant to Section 112 of the Clean Air Act and addressing seven pollutants, only two pertain to municipal waste combustors.

The national emission standard for beryllium applies to combustors used in the process of burning waste for the primary purpose of reducing the volume of the waste by removing combustible matter. The facility has to be processing "beryllium-containing waste" as defined in the regulation. The emissions of beryllium to the atmosphere as listed in NESHAP Subpart C cannot exceed 10 grams of beryllium per day. As an alternative, an owner or operator may demonstrate that ambient air concentrations in the vicinity of the combustor do not exceed 0.01 ug/m^3 beryllium averaged over a 30-day period, for a three year ambient monitoring sampling period. Unless this ambient level was demonstrated prior to promulgations of the standard, the

source would have to comply with the 10 grams per day limit while collecting ambient data to demonstrate compliance with the alternative ambient standard.

The mercury NESHAP covers only those municipal waste combustors that combust wastewater treatment plant sludge. Emissions from these facilities cannot exceed 3200 grams of mercury per day. Work is underway on assessing the need for development of NESHAPs for sources of cadmium and chromium.

8.1.2 State Regulations and Programs

State Requirements Limiting PM Emissions

Existing State regulations for municipal waste facilities were reviewed in the 1979 municipal waste combustor NSPS review. Every State was identified as having an explicit standard for particulate emissions resulting from combustion of municipal waste.[1] The State survey identified 23 States that referenced Subpart E in their regulations or had standards identical to Subpart E. Nine States had less stringent standards and did not reference Subpart E. Massachusetts and Illinois (0.05 gr/dscf), and Maryland (0.03 gr/dscf) were identified as having more stringent standards than the NSPS.

The remaining 14 States listed the particulate matter emission rate as a function of the waste being combusted, e.g., lb allowable particulate matter/lb waste burned. Of these States, 11 had less stringent standards, and Delaware, Nevada, and North Carolina had more stringent standards, if a 300 ton/day combustor and 4,450 Btu/lb refuse higher heat value is assumed.[4]

The State regulations were again reviewed for this study and essentially the same results were obtained as in the previous survey. However, the States of Texas, New Mexico, and California did not appear to list a specific regulation concerning the combustion of municipal waste. These States were contacted for clarification of their State regulations.

New Mexico does not have a specific requirement for municipal waste combustion that limits particulate matter emissions but does have an opacity requirement of 20 percent. Texas also has no specific regulation listing a quantitative limit for combustor emissions. In both of these States, new sources are subject to review and may have to apply for PSD permits. However, in both Texas and New Mexico, pollutant emissions from each new source are examined on a case-by-case basis and if PSD is applicable, a BACT determination establishes what quantitative emission limits will be applied to new or modified facilities.

In the State of California each local air quality district can establish its own emission limit requirements. Guidelines on emission limits from municipal waste combustion facilities have been published in the California Air Resources Board (CARB) Air Pollution Control of Resource Recovery Facilities.[5] A summary of the CARB guideline emission limits is presented in Table 8-2. California is the only State to establish guidelines that make a distinction in particulate size of total particulate matter and particulate matter less than 2 microns in size. The guideline emission limit for total suspended PM of 0.01 gr/dscf at 12 percent CO_2 is the most stringent emission limit identified in this review of State regulations.

The State of New Jersey has also published air pollution control guidelines for resource recovery facilities and combustors.[6] A summary of the guideline emission limits are also presented in Table 8-2. The New Jersey resource recovery and combustor guidelines require stack testing for total PCDD, total PCDF, formaldehyde, benzo(a)pryene, polychlorinated biphenyls (PCBs) and other organic substances regulated in N.J.A.C. 7:27-17 (Control and Prohibition of Air Pollution by Toxic Substances). Stack emission rates must be estimated for lead, mercury, beryllium, arsenic, cadmium, chromium, and nickel.

The State of New York has drafted operating requirements for municipal waste combustion.[7] A summary of these proposed guideline emission limits is included in Table 8-2. The same type of emission tests as required by the State of New Jersey for criteria pollutants and trace contaminants (both heavy metals and specific organic compounds) are required by the State of New York.

TABLE 8-2. GUIDELINE EMISSION LIMITS FOR MUNICIPAL WASTE COMBUSTION[5,6,7]

Pollutant	California[a]	New Jersey	New York[b] (Proposed)
TSP[b] (Total)	0.01 (gr/dscf at 12% CO_2)	0.02 (gr/dscf at 7% O_2)	0.03 (gr/dscf at 12% CO_2)
(less than 2 microns)	0.008 (gr/dscf at 12% CO_2)	---	---
SO_2	30 ppm at 12% CO_2	100 (ppm at 7% O_2)	c
NO_x (as NO_2)	140 - 200 ppm at 12% CO_2	300 (ppm at 7% O_2)	---
CO	400 ppm at 12% CO_2	400 (ppm at 7% O_2)	---
THC (as CH_4)	70 ppm at 12% CO_2	d	---
HCl	30 ppm at 12% CO_2	50 (ppm at 7% O_2)	c
Design	Combustion temperature of 1800°F ± 200°F and residence time of no less than 1 second	---	Combustion temperature of 1500°F based on a 15 min. average of readings

[a]These limits are presented as guidelines because each facility has to be evaluated individually in determining its compliance with local air pollution control district regulations.[5]

[b]Nassau, Suffolk, Rockland, Westchester, and the City of New York 0.02 gr/dscf.

[c]Combined SO_2 and HCl acid gas limit ranging from 105 to 525 ppm.

[d]If nonmethane hydrocarbon emissions are greater than 50 TPY, Lowest Achievable Emission Rate as required by N.J.A.C. 7:27-18 (Emission Offset Rule).

THC = total hydrocarbons.

Pennsylvania has also recently established best available technology guidance for municipal waste combustion. The guidance document specifies emission limits similar to those shown for California in Table 8-2 and includes combustor operating requirements. The State of Washington is also developing a negotiated regulation for municipal waste combustion.

State Programs For Control Of Noncriteria Air Pollutants

Many States and localities use some form of ambient guideline or standard for the control of emissions of non-criteria air pollutants from MWC. Many of these apply time and safety factors to occupational values as a basis for developing the ambient limit. A factored occupational value is the use of a constant fractional value to apply to all of a specific set of occupational limits to convert from a workplace guideline (based on exposure to a particular contaminant over an 8-hour day, 5 days per week) to an ambient guideline. Some States and localities apply different factors to different categories of pollutants based on toxicity or carcinogenity. The occupational limits used most commonly for this purpose are the Threshold Limit Values-Time Weighted Averages (TLV-TWAs) for workplace exposures established by the American Conference of Governmental Industrial Hygienists (ACGIH), the Occupational Safety and Health Administration permissible exposure levels for airborne substances in the work place, and the National Institute for Occupational Safety and Health recommended criteria for occupational exposure in air.

In addition to limiting emissions of noncriteria pollutants based on acceptable ambient limits, several States impose control requirements based on carcinogenic risk assessment. Michigan, for example, requires that sources of carcinogenic emissions apply the best available control technology and imposes a stack limit such that carcinogenic emissions from the source do not cause an estimated lifetime cancer risk greater than 1 in 1,000,000 to the most exposed individual. According to information submitted by States to the National Air Toxics Information Clearinghouse, 24 States plan to use risk assessment on a case-specific basis for sources of carcinogens.

Table 8-3 lists acceptable ambient concentrations or standards and averaging times established by several State and local agencies. The values listed in the table were extracted from data voluntarily submitted by State and local agencies to the National Air Toxics Information Clearinghouse. Acceptable ambient concentrations are listed for pollutants of interest in the municipal waste combustion study for each agency that submitted acceptable ambient concentrations for these pollutants.[8] As the table illustrates, there is a wide variation among acceptable concentrations for various states.

Compliance with the acceptable ambient concentrations listed in Table 8-3 typically must be demonstrated by new sources. Some agencies also make these ambient concentrations applicable to existing sources through the requirement for renewal of their operating permits.

8.1.3 Foreign Regulations

This section describes regulatory approaches and lists emission limits used in several different foreign countries. The MWC emission limits established in West Germany, France, the Netherlands, Japan, Sweden, Norway, and Switzerland are presented in Table 8-4. Occasionally sources of information differed on the emission limit established for a specific pollutant. In these cases, the most recent source was used.

By way of comparison, the U.S. NSPS standard (40 CFR 60, Subpart E) for municipal waste combustor emissions of particulate matter is 180 mg/m^3 corrected to 12 percent CO_2 for facilities which do not recover energy. Direct comparison of the particulate matter emission limit is not possible between the U.S. and countries listed in Table 8-4, because the information sources do not always report the percent CO_2 or O_2 correction.

In Canada, air pollution regulations can be established by each provincial government. An official in the Ministry of the Environment for the Provincial Government of Ontario was contacted for clarification of the regulations as they are applied in that Province.[13] The overall regulatory authority is provided by the Environmental Protection Act of 1971. This Act does not set specific emission limits for pollutants but details the

TABLE 8-3. ACCEPTABLE AMBIENT CONCENTRATIONS REPORTED TO NATICH BY STATE AND LOCAL AGENCIES FOR SELECTED POLLUTANTS[a]

Agency	Averaging[a] Time	Arsenic (ug/m^3)	Cadmium (ug/m^3)	Chromium (ug/m^3)	Formaldehyde (ug/m^3)	Hydrogen Chloride (ug/m^3)	Hydrogen Fluoride (ug/m^3)	Mercury (ug/m^3)	Nickel (ug/m^3)	TCDD (ug/m^3)	Tetrahydrofuran (ug/m^3)
Connecticut	8 hours	0.05	0.40	2.5	12.0	---	50.0	0.2	5.0	---	11,800.0
Illinois	1 year	0.0003	0.0004	1.66	0.015	---	---	0.166[b]	0.0006	---	---
Indiana	8 hours	---	---	---	18.0	---	---	---	---	450.0	---
Kentucky	24 hours	---	---	---	---	---	1.0	---	---	---	---
Massachusetts	24 hours	---	0.005	0.34	0.2	9.5	6.8	---	0.002	1.1[c]	80.0
North Carolina	24 hours	1.0	0.25	0.25	300.0[c]	---	---	3.0[d]	0.5	---	73,500.0[c]
Nevada	8 hours	0.005	0.001	0.012	0.071	0.167	0.06	0.002	0.002	---	14.048
New York	1 year	0.67	2.0	0.167	2.0	140.0	---	0.167	3.3	---	11,800.0
Pa-Philadelphia	1 year	0.024	0.12	0.12	7.2	---	---	0.24	0.24	0.0001	---
Virginia	24 hours	3.30	0.8	0.5	12.0	120.0	20.0	0.8	10.0	3.0	9,800.0
WA-Olympia	---	---	---	---	0.05 ppm	---	---	---	---	---	---

[a]Averaging time unless otherwise noted.
[b]Averaging time is 24 hours.
[c]Averaging time is 1 year, units are pg/m^3.
[d]Averaging time is 15 minutes.

TABLE 8-4. FOREIGN REGULATIONS FOR MUNICIPAL WASTE COMBUSTION[9-12]

Pollutant	Emission Limits (mg/m^3)						
	West Germany	France	Netherlands	Japan[a]	Sweden[b]	Norway	Switzerland
Particulate Matter	50	150 - 1000 (at 7% CO_2)	100 ÷ f, f = % CO_2 in combustion gas (at 7% CO_2)	Continuous furnace 100 to 700 (at 12% O_2) Other 700 or less at 12% O_2	20 at 10% CO_2 as a monthly average	100	50
Sulfur dioxide	200	---	600	c	---	---	---
Nitrogen dioxide	500	---	300	250 ppm[d] at 12% O_2	---	---	---
Carbon monoxide	100	Less than 0.1%	---	---	100	---	100
Hydrogen chloride	100	---	1000	700 or lower[e] at 12% O_2	100 at 10% CO_2	100	30
Hydrogen fluoride	5	---	20	---	---	---	5
Chlorine	100	---	---	---	---	---	---
Fluorine	5	---	---	---	---	---	---
Dioxin Compounds	---	---	---	---	0.5-2.0 ng/m^3 at 10% CO_2 at existing facilities; 0.1 ng/m^3 at 10% CO_2 at new facilities	---	---
Nickel	1	---	---	---	---	---	---
Chromium	1	---	---	---	---	---	---
Lead	5	---	---	---	---	---	1.5
Zinc	---	---	---	---	---	---	3.8
Copper	5	---	---	---	---	---	---
Cadmium	0.2	---	---	---	---	---	0.1
Mercury	0.2	---	---	---	0.03 at 10% CO_2	---	0.1
Design Combustion Gas Temperature	800°C (1472°F) for 0.3 seconds	750°C (1382°F) for at least 2 seconds	---	---	800°C (1472°F)	---	---

[a]Particulate matter standard level for a continuous furnace can be satisfied by installing an ESP.

[b]Typical value, incomplete listing of pollutants regulated. These are requirements suggested in a 1986 restudy, not an actual regulation. Re-collection of mercury batteries from urban refuse is recommended to reduce environmental hazard of mercury.

[c]Value calculated by equation 9 (Nm^3/n) or lower where $9 = k \times 10^{-3} \times He^2$, where K = value determined by respective region, He = effective stack height.

[d]Only for plants constructed after June 18, 1977, and with a volume flow greater than 40,000 Nm^3/hr or higher.

[e](430 ppm or lower). Regulation effective December 1, 1979, and after for existing plants; June 18, 1979, and after for newly constructed plants.

procedure to be followed for making dispersion calculations to estimate the maximum impact of a pollutant wherever it may occur beyond the property line boundary of the source. This maximum concentration, referred to as an impingement point concentration, can occur at ground-level or within the body of the plume as in the case of plume impact on high-rise buildings. Impingement point concentration limits have been established for numerous pollutants including 100 ug/m^3 for PM, 800 ug/m^3 for SO_2, 500 ug/m^3 for NO_x, 100 ug/m^3 for HCl, and 0.03 ug/m^3 for beryllium. The maximum predicted ambient concentration of a pollutant from a source cannot exceed the impingement point concentration value. No single set of impingement point concentration limits applied specifically to municipal waste combustors.

The Province of Ontario is also considering changes to present provisional standard concentration limits for the total concentration of chlorinated dibenzo-p-dioxins (CDD) and chlorinated dibenzofurans (CDF) of 450 picograms/m^3 as a half-hour average and 30 picograms/Nm^3 as an annual average. The values of the impingement point concentrations will probably not change, just the method of determining compliance. The present method of compliance requires that the sum of the tetra- through octa-CDD concentrations and 1/50 of the tetra- through octa-CDF concentrations be compared to the half-hour and annual concentration standards. The factor of 1/50 is currently under review and will probably be changed.[13]

Since 1974, when the regulations governing MWC in West Germany were established, new combustion units in West Germany have been required to have ESPs followed by partial scrubbing.[14] Emissions from municipal waste combustors, especially dust, trace metals, and acid gases, have for a long time been the subject of concern in West Germany.

The 46 resource recovery plants in West Germany burn 9.9 million tons of trash each year, representing 34 percent of the municipal waste generated annually in West Germany. MWC facilities in West Germany practice comprehensive continuous monitoring, monitoring not only combustion factors such as CO, O_2, and temperature, but also particulates, HCl, HF, SO_2, and NO_x. West German resource recovery plants can and indeed have been temporarily shut down when monitoring indicates that a facility is in violation of emission limits for more than one hour. In addition to

emission limitations, all workers at the West German facilities are required to attend training schools.[12]

Two countries in particular, Sweden and Denmark, have responded to a recently acknowledged potential hazard from CDD/CDF emissions to public health, taking actions that affect municipal waste combustors. In early 1985, the Swedish Environmental Protection Agency (SNV) declared a one year moratorium on the licensing and construction of new municipal waste combustors because high concentrations of CDD/CDF had been found in, among other things, fish and breast milk. In June 1986, the SNV recommended that the moratorium be lifted provided that requirements for stack gas purification are implemented. Requirements which were recommended in a study conducted during the moratorium include:

- Hydrochloric acid gas: discharges should not exceed 100 mg/Nm^3, dry gas, 10 percent CO_2, counted as a monthly average.

- Mercury: discharges should not exceed 0.08 mg/Nm^3 dry gas, 10 percent CO_2, when inspected. As product control measures (e.g., removal of mercury batteries from the waste) are implemented, the value should be further lowered towards 0.03 mg/Nm^3.

- Dust: the discharges should not exceed 20 mg/Nm^3, dry gas, 10 percent CO_2, counted as a monthly average.

- CDD/CDF compounds: the discharges from existing facilities should not exceed a standard value of 0.5 - 2.0 ng/Nm^3, dry gas, 10 percent CO_2, when inspected. For future facilities the guideline should be a standard value of 0.1 ng/Nm^3, dry gas, 10 percent CO_2. The values refer to TCDD-equivalences calculated according to the Eadons model and measured in accordance with the Nordic Dioxine-group's recommendation at normal operations. Given values should be used as guidelines during a test period. Definite guidelines should be established following the expiration

of the test period in each case. A test period of two years for the evaluation of the experiences of the new environmental protection technique is required.[15]

The study estimated that emissions of mercury, CDD/CDF and hydrogen chloride can be reduced by about 90 percent. Of the 7 million metric tons (7.7 tons) of waste produced each year in Sweden, almost 2.5 million metric tons (2.75 tons) can be combusted.[15]

A quantification of the sources of CDD/CDF in Sweden is not possible with current knowledge. However, waste combustion is believed to be a significant source. Sources outside Sweden may also be of significance.[15] The Swedish EPA does not want to eliminate waste combustion as a suitable treatment method for waste and, in fact, feels that CDD/CDF emissions can be controlled by the use of good combustion practices.[16] The following techniques for control of various pollutants are currently under investigation: support fuel burning, good operating practices, good instrumentation for operating and emission monitoring, and the use of highly efficient stack gas scrubbing systems.

As a result of the first phase of a study completed in December of 1984, EPA in Denmark closed eight community waste combustors predicted to emit unacceptable amounts of CDD/CDF.[17] As a result of these closures, it is anticipated that Denmark will establish emission limits for CDD/CDF from MWC facilities. The Danish EPA has been developing guidelines limiting emissions from MWC. Scheduled for completion in 1986, these guidelines would become effective in May 1987.

In Switzerland, 14 facilities burn about 75 percent of the municipal waste generated annually. Swiss regulations limit emissions of particulates, HCl, HF, CO, and metals, but not NO_x. After the current two-year grace period, plants out of compliance could be closed. Higher level workers in Swiss facilities are trained at West German schools while other workers are trained on-site. Facilities in Switzerland practice continuous monitoring of O_2, particulates, temperature, HCl, and SO_2.[12]

Five resource recovery facilities in Norway burn approximately five percent of the municipal waste generated there. One additional

facility in Oslo burns 100 percent of the municipal waste generated in that city. Regulatory requirements limit emissions of particulate matter and HCl, and a plant can be closed for emissions violations although there is no automatic closing requirement. No facility has ever been closed for a violation. Regulations require continuous monitoring of O_2, particulates, and temperature and continuous ambient air measurements outside the plant for HCl and heavy metals.

8.2 LAND DISPOSAL REGULATIONS AND PROGRAMS

There are two areas of land disposal programs and regulations which could affect MWC. The first is direct landfill of municipal waste. The second is disposal of the ash from MWC.

8.2.1 Land Disposal of Municipal Waste

As previously discussed, direct landfill of municipal waste has been the most common method of disposal. However, new landfills are having to meet increasingly stringent regulations. Non-hazardous waste disposal management and techniques are governed by Section 4004 of the Resource Conservation and Recovery Act. This section requires states to implement disposal programs that will protect the environment (especially groundwater) from contamination. The EPA has also published guidelines for the states concerning what their disposal management programs should contain.

The impact of these new regulations is making landfills more difficult to site, and more expensive to operate. This trend will tend to encourage methods of reducing waste volume, such as combustion and/or recycling.

8.2.2 Land Disposal of Ash

The Resource Conservation and Recovery Act applies to disposal of the bottom ash and collected fly ash from municipal waste combustion facilities. These residues generally contain metals such as lead and cadmium. The presence of large concentrations of such metals could cause the residues to

be classified as a hazardous waste. Owners and operators of municipal waste combustion facilities are obligated to determine if their ash residues are hazardous wastes. They may do so by testing it for EP toxicity (as described in 40 CFR Section 261.24). EPA has recently proposed replacing the EP toxicity test with the Toxicity Characteristic Leaching Procedure (TCLP) (51 FR 21685, June 13, 1986).

EPA has reviewed data from the literature concerning results of EP tests on ash. The agency has no information to indicate the reliability of these data. A majority of the fly ash tests reported indicate levels of lead or cadmium above regulatory thresholds. Few tests of bottom ash or combined fly and bottom ash indicate levels of metals above regulatory thresholds. EPA is in the process of obtaining more reliable data on ash characteristics and leachability.

If the ash generated by a municipal waste combustion facility must be managed as a hazardous waste, the cost of managing that ash can be expected to increase substantially.

8.3 MATERIALS SEPARATION AND RECYCLING

As mentioned earlier in this report, one of the influences on the increased interest in combustion of municipal waste is increasingly scarce landfill space. Another waste management technique for reducing waste volume receiving increased attention is recycling materials from municipal waste, thereby avoiding discarding them at all. Renewed interest in recycling is being seen across the U.S. but particularly in the Northeast where landfill shortages are the most acute.

In 1984 about 10 percent of material would otherwise end up in disposal facilities was recovered from municipal waste and reused. Most of the recovery in the U.S. was accomplished through source separation, that is manual separation by the generator, rather than separation from mixed refuse in centralized waste processing facilities. There are thousands of source separation programs in operation across the U.S., including 400 to 500

curbside recycling programs. Some programs have made participation mandatory. In addition, some plants producing refuse derived fuel are separating materials (mostly non-combustibles) from mixed refuse.

Centralized processing methods are becoming increasingly sophisticated and effective at separating waste materials. A noteable state-of-the-art system operating in Europe, the Sorain-Cecchini process, is an integrated recovery system that can produce paper pulp, animal feed, compost, aluminum scrap, ferrous scrap, densified refuse derived fuel, and peletized polyethylene for production of sheet plastic used in garbage bags.

Methods for separation and uses for recovered materials have been established for paper, glass, scrap ferrous metals, aluminum, wood waste, yard waste, and rubber. Also, separation methods and markets for recovered plastics are currently the subject of rapidly advancing research. At the present time, technical and economic factors combine to make paper and aluminum the most extensively recycled materials from U.S. waste.

In general, recycling of noncombustible materials would have a positive effect on combustion operation in most localities, allowing for smaller equipment, more reliable operation, and decreased ash handling requirements. On the other hand, the effect of the removal of combustibles, particularly paper, on the feasibility of incineration should be considered in the context of local refuse characteristics. Since paper contains the largest portion of the heating value in the waste, recycling goals for paper should be considered as a part of an integrated waste management program which includes consideration of both recycling and combustion. See the Volume titled "Municipal Waste Combustion Study: Recycling of Solid Waste;" EPA/530-SW-87-021i for more information on the status of recycling activities.

8.4 OTHER ISSUES

There are two changes in the tax laws which are relevant to the industry. The first placed limits on the amount of industrial development bonds that States can issue. Also, a proposed change would remove the Federal tax exemption from all private purpose municipal bond issues. Therefore, MWC facilities which are privately owned and operated would no

longer be eligible for tax exempt financing. Though Congress recently enacted tax law changes, the practical effect of the changes has not yet been determined. Both of these factors could increase the cost of raising capital for new facilities. These tax considerations may also lead to increased benefits for public ownership rather than private ownership.

One significant revenue source for new facilities is energy sales, either in the form of steam or electricity. The economic value of the energy sales is directly tied to the cost of the fossil fuel which would otherwise be burned. Therefore, as energy prices decline, the values of the steam and electricity sales also decline. However, the recent drop in energy prices does not appear to have had a significant impact on planned facilities.

Another issue is public resistance to having a municipal waste combustor near residential neighborhoods. For example, plans to construct one plant in New York encountered significant public opposition.[19] Concerns often raised by the public include toxicity of potential emissions, safety, noise, odor, and traffic congestion.

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APPENDIX A

EXISTING MWC FACILITIES

This appendix contains a listing of all MWC facilities believed to be in operation or expected to be operating as of the end of 1986. The data were obtained from telephone surveys, EPA regional offices, and trade journals. Some of the data sources used are surveys done prior to the completion of this report. Although efforts were made to update information where possible, some of the facilities shown here may currently be temporarily or permanently shut down.

The first table (Table A-1) lists existing facilities ordered by design type and size. The second table (Table A-2) presents existing facilities aggregated by state and design type. The last table (Table A-3) presents modeling input parameters used in the Human Exposure Model (HEM).

Some minor differences may be noted between Table A-3 and Tables A-1 and A-2. In order to make the results of the HEM available for inclusion in this integrated study, an earlier version of Tables A-1 and A-2 were used to develop the modeling input parameters shown in Table A-3. However, in order to provide the best available data for industry investigation, Tables A-1 and A-2 were updated and the updated information has been included here.

TABLE A-1. EXISTING FACILITIES ORDERED BY DESIGN TYPE AND SIZE

LOCATION		COMBUSTOR	HEAT	# OF	TOTAL PLANT CAPACITY	TYPE OF	STARTUP	
CITY	STATE	TYPE	RECOVERY	COMBUSTORS	(TPD)	CONTROL(S)	DATE	REFERENCES
Harrisonburg	VA	MB/OF	YES	2	100	ESP	1982	
New Canaan	CT	MB/OF	NO	1	108	WWS	NA	
Portsmouth	VA	MB/OF	YES	2	160	ESP	1971	
Waukesha	WI	MB/OF	YES	2	175	ESP	1971	
Stamford I	CT	MB/OF	YES	1	200	ESP	1974	DIRECT CONTACT TO FACILITY 3/87
Shreveport	LA	MB/OF	NO	1	200	WWS	NA	
Hampton	VA	MB/OF	YES	2	200	ESP	1980	
Euclid	OH	MB/OF	NO	NA	200	ESP	NA	STATE OF OHIO
Wilmington	NC	MB/OF	YES	2	200	ESP	1984	
Sheboygan	WI	MB/OF	NO	2	240	WS	NA	STATE OF WISCONSIN
Glen Cove	NY	MB/OF	YES	2	250	ESP	1983	NEW YORK STATE
Stamford II	CT	MB/OF	YES	1	360	ESP	1974	DIRECT CONTACT TO FACILITY 3/87
Norfolk (Navy Station)	VA	MB/OF	YES	2	360	ESP	1967	
Nashville (Expansion)	TN	MB/OF	YES	1	400	ESP	1986	CITY CURRENTS 10/86
Ogden	UT	MB/OF	YES	3	450	ESP	NA	
East Chicago	IN	MB/OF	NO	2	450	WWS	1971	DIRECT CONTACT TO FACILITY 3/87
Huntington	NY	MB/OF	NO	3	450	WS	NA	
Framingham	MA	MB/OF	NO	2	500	DS/BAG	1970	DIRECT CONTACT TO FACILITY 3/87
Marion County	OR	MB/OF	YES	2	550	DS/BAG	1986	
Honolulu	HA	MB/OF	NO	1	600	ESP	1970	DIRECT CONTACT TO FACILITY 3/87
Fall River	MA	MB/OF	NO	2	600	WS	1972	DIRECT CONTACT TO FACILITY 3/87
Clinton (Grosse Pointe)	MI	MB/OF	NO	2	600	ESP	NA	MICHIGAN APC
S.E. Oakland Co.	MI	MB/OF	NO	2	600	WS	NA	MICHIGAN APC
N.Dayton	OH	MB/OF	NO	2	600	ESP	1970	
S.Dayton	OH	MB/OF	NO	2	600	ESP	1970	
Harrisburg	PA	MB/OF	YES	2	720	ESP	1973	
Nashville	TN	MB/OF	YES	2	720	ESP	1974	CITY CURRENTS 10/86
Philadelphia (E.Central Unit)	PA	MB/OF	NO	2	750	ESP	1965	DIRECT CONTACT TO FACILITY 3/87
Tulsa	OK	MB/OF	YES	2	750	ESP	1986	
Brooklyn (SW)	NY	MB/OF	NO	3	750	ESP	NA	
Philadelphia (Northwest Unit)	PA	MB/OF	NO	2	750	ESP	1957	DIRECT CONTACT TO FACILITY 3/87
St. Louis (1 and 2)	MO	MB/OF	NO	4	800	WS	NA	
Tampa	FL	MB/OF	YES	4	1000	ESP	1985	
Brooklyn (N.Henry St.)	NY	MB/OF	NO	1	1000	ESP	NA	
New York (Betts Avenue)	NY	MB/OF	YES	4	1000	ESP	NA	
Washington(Solid Waste Red.Cent.I)	DC	MB/OF	NO	4	1000	ESP	1972	DIRECT CONTACT TO FACILITY 2/87
Louisville	KY	MB/OF	NO	4	1000	WS	NA	MRI
Pinellas Co. (Expansion)	FL	MB/OF	YES	1	1150	ESP	1986	CITY CURRENTS 10/86
Baltimore (Pulaski)	MD	MB/OF	NO	4	1200	ESP	NA	
Saugus	MA	MB/OF	YES	2	1500	ESP	1985	
North Andover	MA	MB/OF	YES	2	1500	ESP	1985	CITY CURRENTS 10/86
Chicago (NW Waste to Energy Fac)	IL	MB/OF	YES	4	1600	ESP	1970	
Pinellas Co.	FL	MB/OF	YES	2	2000	ESP	1983	CITY CURRENTS 10/86
Baltimore (RESCO)	MD	MB/OF	YES	3	2250	ESP	1985	
Westchester Co.	NY	MB/OF	YES	3	2250	ESP	1984	
Galax	VA	MB/RC	YES	1	56	BAG	NA	CITY CURRENTS 10/86
Gallatin	TN	MB/RC	YES	2	200	ESP	1981	DIRECT CONTACT TO FACILITY 2/87
Mayport Naval Station	FL	MI/EA	YES	1	48	C	1978	CITY CURRENTS 10/86

TABLE A-1. EXISTING FACILITIES ORDERED BY DESIGN TYPE AND SIZE (Continued)

LOCATION		COMBUSTOR	HEAT	# OF	TOTAL PLANT CAPACITY	TYPE OF	STARTUP	
CITY	STATE	TYPE	RECOVERY	COMBUSTORS	(TPD)	CONTROL(S)	DATE	REFERENCES
Bellingham	WA	MI/EA	YES	1	100	NONE	1986	
Pittsfield	MA	MI/EA	YES	3	240	EGB	1981	
Auburn	NH	MI/SA	NO	1	5	NONE	NA	
Nottingham	NH	MI/SA	NO	1	8	NONE	1972	DIRECT CONTACT TO FACILITY 3/87
Canterbury	NH	MI/SA	NO	1	10	NONE	NA	
Skaneateless	NY	MI/SA	NO	1	13	NONE	1975	DIRECT CONTACT TO FACILITY 3/87
Harpswell	ME	MI/SA	NO	1	14	NONE	NA	
Candia	NH	MI/SA	NO	1	15	NONE	NA	
Wolfeboro	NH	MI/SA	NO	2	16	NONE	1975	DIRECT CONTACT TO FACILITY 3/87
Gatesville	TX	MI/SA	YES	1	20	NONE	NA	
Litchfield	NH	MI/SA	NO	1	22	NONE	NA	
Groveton	NH	MI/SA	YES	1	24	NONE	NA	
Sitka	AK	MI/SA	YES	2	25	ESP	1985	CITY CURRENTS 10/86
Palestine	TX	MI/SA	YES	1	28	WS	NA	
Wilton	NH	MI/SA	NO	1	30	NONE	NA	
Meredith	NH	MI/SA	NO	2	31	NONE	NA	
Newport News (Ft. Eustis)	VA	MI/SA	YES	1	35	NONE	1980	
Carthage City	TX	MI/SA	YES	1	36	NONE	1985	STATE OF TEXAS
Center	TX	MI/SA	YES	1	36	NONE	1985	STATE OF TEXAS
Hope	AR	MI/SA	NO	3	38	NONE	NA	
Pittsfield	NH	MI/SA	NO	1	48	NONE	NA	
Waxahachie	TX	MI/SA	YES	2	50	WS	1982	CITY CURRENTS 10/86
Batesville	AR	MI/SA	YES	1	50	NONE	1981	
Cassia County	ID	MI/SA	YES	2	50	NONE	1982	
Johnsonville	SC	MI/SA	YES	1	50	NONE	NA	
Collegeville (St. Johns)	MN	MI/SA	YES	1	50	WS	1981	CITY CURRENTS 10/86
Osceola	AR	MI/SA	YES	2	50	NONE	1980	
Wrightsville	NC	MI/SA	NO	2	50	NONE	NA	TRIP REPORT
Savage	MN	MI/SA	YES	1	60	ESP	NA	DEPARTMENT OF AIR QUALITY (MN)
Lewisburg	TN	MI/SA	YES	1	60	WS	1980	CITY CURRENTS 10/86
Stuttgart	AR	MI/SA	NO	3	60	NONE	NA	MRI
Blytheville	AR	MI/SA	NO	2	70	NONE	1983	DIRECT CONTACT TO FACILITY 2/87
Red Wing	MN	MI/SA	YES	1	72	ESP	1982	
Fort Leonard Wood	MO	MI/SA	YES	3	75	NONE	NA	
Livingston	MT	MI/SA	YES	2	75	NONE	1982	
Simpson Co. (Franklin)	KY	MI/SA	YES	2	77	NONE	NA	STATE OF KENTUCKY
Purham	MN	MI/SA	YES	2	80	ESP	1986	DEPARTMENT OF AIR QUALITY (MN)
Barron County	WI	MI/SA	NO	2	80	ESP	1986	STATE OF WISCONSIN
Dyersburg	TN	MI/SA	YES	1	100	NONE	1980	CITY CURRENTS 10/86
Bellingham	WA	MI/SA	YES	2	100	NONE	1986	
Salem	VA	MI/SA	YES	4	100	NONE	1970	
North Little Rock	AR	MI/SA	YES	4	100	NONE	1977	CITY CURRENTS 10/86
Hot Springs	AR	MI/SA	NO	8	100	NONE	NA	
Durham	NH	MI/SA	YES	3	108	C	1980	DIRECT CONTACT TO FACILITY 2/87
Miami	OK	MI/SA	YES	3	108	NONE	1982	DIRECT CONTACT TO FACILITY 2/87
Windham	CT	MI/SA	YES	3	108	BAG	1981	
Cattaraugus Co. (Cuba)	NY	MI/SA	YES	3	112	NONE	1983	CITY CURRENTS 10/86
Cleburne	TX	MI/SA	YES	3	115	ESP	1986	STATE OF TEXAS, CITY CURRENTS 10/86

TABLE A-1. EXISTING FACILITIES ORDERED BY DESIGN TYPE AND SIZE (Continued)

LOCATION		COMBUSTOR TYPE	HEAT RECOVERY	# OF COMBUSTORS	TOTAL PLANT CAPACITY (TPD)	TYPE OF CONTROL(S)	STARTUP DATE	REFERENCES
CITY	STATE							
Pascagoula	MS	MI/SA	YES	2	150	ESP	1985	
Oswego County (Volney)	NY	MI/SA	YES	4	200	ESP	1985	
Oneida Co. (Rome)	NY	MI/SA	YES	4	200	NONE	1985	
Auburn	ME	MI/SA	YES	4	200	BAG	1981	
Portsmouth	NH	MI/SA	YES	4	200	BAG	1982	
Hampton	SC	MI/SA	YES	3	270	ESP	1985	CONSUMAT
Tuscaloosa	AL	MI/SA	YES	4	300	ESP	1984	CITY CURRENTS 10/86
Duluth	MN	RDF	YES	2	400	VWS	NA	
Albany	NY	RDF	YES	2	600	ESP	1981	
Akron	OH	RDF	YES	3	1000	ESP	1979	
Haverhill/Lawrence	MA	RDF	YES	3	1300	ESP	1984	CITY CURRENTS 10/86
Columbus	OH	RDF	YES	6	2000	ESP	1983	
Niagra Falls	NY	RDF	YES	2	2200	ESP	1981	
Dade Co.	FL	RDF	YES	4	3000	ESP	1982	CITY CURRENTS 10/86, MRI
Ames	IA	RDF/C	YES	2	200	ESP	1975	DIRECT CALL TO FACILITY 3/87
Lakeland	FL	RDF/C	YES	3	300	ESP	1981	CITY CURRENTS 10/86
Madison	WI	RDF/C	YES	2	400	ESP/C	1979	CITY CURRENTS 10/86

KEY

COMBUSTOR TYPES:
- MI/SA = MODULAR COMBUSTOR WITH STARVED AIR
- MI/EA = MODULAR COMBUSTOR WITH EXCESS AIR (VICON)
- RDF = REFUSE DERIVED FUEL FIRED IN DEDICATED BOILER
- RDF/C = REFUSE DERIVED FUEL/COAL COFIRING
- MB/OF = MASS BURN WITH OVERFEED STOKER
- MB/RC = MASS BURN IN ROTARY COMBUSTOR

TYPES OF CONTROLS:
- C = CYCLONE
- ESP = ELECTROSTATIC PRECIPITATOR
- WS = WET SCRUBBER
- DS = DRY SCRUBBER
- VWS = VENTURI WET SCRUBBER
- BAG = BAGHOUSE
- EGB = ELECTROSTATIC GRAVEL BED

NA = DATA NOT AVAILABLE OR TECHNOLOGY UNDECIDED

TABLE A-2. EXISTING FACILITIES ORDERED BY STATE AND DESIGN TYPE

LOCATION		COMBUSTOR	HEAT	# OF	TOTAL PLANT CAPACITY	TYPE OF	STARTUP	
CITY	STATE	TYPE	RECOVERY	COMBUSTORS	(TPD)	CONTROL(S)	DATE	REFERENCES
Sitka	AK	MI/SA	YES	2	25	ESP	1985	CITY CURRENTS 10/86
Tuscaloosa	AL	MI/SA	YES	4	300	ESP	1984	CITY CURRENTS 10/86
Hope	AR	MI/SA	NO	3	38	NONE	NA	
Batesville	AR	MI/SA	YES	1	50	NONE	1981	
Blytheville	AR	MI/SA	NO	2	70	NONE	1983	DIRECT CONTACT TO FACILITY 2/87
Osceola	AR	MI/SA	YES	2	50	NONE	1980	
North Little Rock	AR	MI/SA	YES	4	100	NONE	1977	CITY CURRENTS 10/86
Stuttgart	AR	MI/SA	NO	3	60	NONE	NA	MRI
Hot Springs	AR	MI/SA	NO	8	100	NONE	NA	
New Canaan	CT	MB/OF	NO	1	108	VWS	NA	
Stamford I	CT	MB/OF	YES	1	200	ESP	1974	DIRECT CONTACT TO FACILITY 3/87
Stamford II	CT	MB/OF	YES	1	360	ESP	1974	DIRECT CONTACT TO FACILITY 3/87
Windham	CT	MI/SA	YES	3	108	BAG	1981	
Washington(Solid Waste Red.Cent.I)	DC	MB/OF	NO	4	1000	ESP	1972	DIRECT CONTACT TO FACILITY 2/87
Dade Co.	FL	RDF	YES	4	3000	ESP	1982	CITY CURRENTS 10/86, MRI
Pinellas Co.	FL	MB/OF	YES	2	2000	ESP	1983	CITY CURRENTS 10/86
Pinellas Co. (Expansion)	FL	MB/OF	YES	1	1150	ESP	1986	CITY CURRENTS 10/86
Tampa	FL	MB/OF	YES	4	1000	ESP	1985	
Mayport Naval Station	FL	MI/EA	YES	1	48	C	1978	CITY CURRENTS 10/86
Lakeland	FL	RDF/C	YES	3	300	ESP	1981	CITY CURRENTS 10/86
Honolulu	HA	MB/OF	NO	1	600	ESP	1970	DIRECT CONTACT TO FACILITY 3/87
Ames	IA	RDF/C	YES	2	200	ESP	1975	DIRECT CALL TO FACILITY 3/87
Cassia County	ID	MI/SA	YES	2	50	NONE	1982	
Chicago (NW Waste to Energy Fac)	IL	MB/OF	YES	4	1600	ESP	1970	
East Chicago	IN	MB/OF	NO	2	450	VWS	1971	DIRECT CONTACT TO FACILITY 3/87
Louisville	KY	MB/OF	NO	4	1000	WS	NA	MRI
Simpson Co. (Franklin)	KY	MI/SA	YES	2	77	NONE	NA	STATE OF KENTUCKY
Shreveport	LA	MB/OF	NO	1	200	VWS	NA	
Haverhill/Lawrence	MA	RDF	YES	3	1300	ESP	1984	CITY CURRENTS 10/86
Fall River	MA	MB/OF	NO	2	600	WS	1972	DIRECT CONTACT TO FACILITY 3/87
Framingham	MA	MB/OF	NO	2	500	DS/BAG	1970	DIRECT CONTACT TO FACILITY 3/87
North Andover	MA	MB/OF	YES	2	1500	ESP	1985	CITY CURRENTS 10/86
Saugus	MA	MB/OF	YES	2	1500	ESP	1985	
Pittsfield	MA	MI/EA	YES	3	240	EGB	1981	
Baltimore (Pulaski)	MD	MB/OF	NO	4	1200	ESP	NA	
Baltimore (RESCO)	MD	MB/OF	YES	3	2250	ESP	1985	
Harpswell	ME	MI/SA	NO	1	14	NONE	NA	
Auburn	ME	MI/SA	YES	4	200	BAG	1981	
Clinton (Grosse Pointe)	MI	MB/OF	NO	2	600	ESP	NA	MICHIGAN APC
S.E. Oakland Co.	MI	MB/OF	NO	2	600	WS	NA	MICHIGAN APC
Duluth	MN	RDF	YES	2	400	VWS	NA	
Savage	MN	MI/SA	YES	1	60	ESP	NA	DEPARTMENT OF AIR QUALITY (MN)
Purham	MN	MI/SA	YES	2	80	ESP	1986	DEPARTMENT OF AIR QUALITY (MN)
Red Wing	MN	MI/SA	YES	1	72	ESP	1982	
Collegeville (St. Johns)	MN	MI/SA	YES	1	50	WS	1981	CITY CURRENTS 10/86
St. Louis (1 and 2)	MO	MB/OF	NO	4	800	WS	NA	
Fort Leonard Wood	MO	MI/SA	YES	3	75	NONE	NA	
Pascagoula	MS	MI/SA	YES	2	150	ESP	1985	

TABLE A-2. EXISTING FACILITIES ORDERED BY STATE AND DESIGN TYPE (Continued)

LOCATION		COMBUSTOR	HEAT	# OF	TOTAL PLANT CAPACITY	TYPE OF	STARTUP	
CITY	STATE	TYPE	RECOVERY	COMBUSTORS	(TPD)	CONTROL(S)	DATE	REFERENCES
Livingston	MT	MI/SA	YES	2	75	NONE	1982	
Wilmington	NC	MB/OF	YES	2	200	ESP	1984	
Wrightsville	NC	MI/SA	NO	2	50	NONE	NA	TRIP REPORT
Litchfield	NH	MI/SA	NO	1	22	NONE	NA	
Durham	NH	MI/SA	YES	3	108	C	1980	DIRECT CONTACT TO FACILITY 2/87
Wilton	NH	MI/SA	NO	1	30	NONE	NA	
Auburn	NH	MI/SA	NO	1	5	NONE	NA	
Pittsfield	NH	MI/SA	NO	1	48	NONE	NA	
Meredith	NH	MI/SA	NO	2	31	NONE	NA	
Groveton	NH	MI/SA	YES	1	24	NONE	NA	
Portsmouth	NH	MI/SA	YES	4	200	BAG	1982	
Nottingham	NH	MI/SA	NO	1	8	NONE	1972	DIRECT CONTACT TO FACILITY 3/87
Candia	NH	MI/SA	NO	1	15	NONE	NA	
Wolfeboro	NH	MI/SA	NO	2	16	NONE	1975	DIRECT CONTACT TO FACILITY 3/87
Canterbury	NH	MI/SA	NO	1	10	NONE	NA	
Albany	NY	RDF	YES	2	600	ESP	1981	
Niagra Falls	NY	RDF	YES	2	2200	ESP	1981	
Brooklyn (SW)	NY	MB/OF	NO	3	750	ESP	NA	
Glen Cove	NY	MB/OF	YES	2	250	ESP	1983	NEW YORK STATE
Westchester Co.	NY	MB/OF	YES	3	2250	ESP	1984	
Brooklyn (N.Henry St.)	NY	MB/OF	NO	1	1000	ESP	NA	
Huntington	NY	MB/OF	NO	3	450	WS	NA	
New York (Betts Avenue)	NY	MB/OF	YES	4	1000	ESP	NA	
Skaneateless	NY	MI/SA	NO	1	13	NONE	1975	DIRECT CONTACT TO FACILITY 3/87
Oneida Co. (Rome)	NY	MI/SA	YES	4	200	NONE	1985	
Cattaraugus Co. (Cuba)	NY	MI/SA	YES	3	112	NONE	1983	CITY CURRENTS 10/86
Oswego County (Volney)	NY	MI/SA	YES	4	200	ESP	1985	
Akron	OH	RDF	YES	3	1000	ESP	1979	
Columbus	OH	RDF	YES	6	2000	ESP	1983	
N.Dayton	OH	MB/OF	NO	2	600	ESP	1970	
S.Dayton	OH	MB/OF	NO	2	600	ESP	1970	
Euclid	OH	MB/OF	NO	NA	200	ESP	NA	STATE OF OHIO
Tulsa	OK	MB/OF	YES	2	750	ESP	1986	
Miami	OK	MI/SA	YES	3	108	NONE	1982	DIRECT CONTACT TO FACILITY 2/87
Marion County	OR	MB/OF	YES	2	550	DS/BAG	1986	
Philadelphia (Northwest Unit)	PA	MB/OF	NO	2	750	ESP	1957	DIRECT CONTACT TO FACILITY 3/87
Philadelphia (E.Central Unit)	PA	MB/OF	NO	2	750	ESP	1965	DIRECT CONTACT TO FACILITY 3/87
Harrisburg	PA	MB/OF	YES	2	720	ESP	1973	
Johnsonville	SC	MI/SA	YES	1	50	NONE	NA	
Hampton	SC	MI/SA	YES	3	270	ESP	1985	CONSUMAT
Nashville	TN	MB/OF	YES	2	720	ESP	1974	CITY CURRENTS 10/86
Nashville (Expansion)	TN	MB/OF	YES	1	400	ESP	1986	CITY CURRENTS 10/86
Gallatin	TN	MB/RC	YES	2	200	ESP	1981	DIRECT CONTACT TO FACILITY 2/87
Dyersburg	TN	MI/SA	YES	1	100	NONE	1980	CITY CURRENTS 10/86
Lewisburg	TN	MI/SA	YES	1	60	WS	1980	CITY CURRENTS 10/86
Cleburne	TX	MI/SA	YES	3	115	ESP	1986	STATE OF TEXAS, CITY CURRENTS 10/86
Carthage City	TX	MI/SA	YES	1	36	NONE	1985	STATE OF TEXAS
Gatesville	TX	MI/SA	YES	1	20	NONE	NA	

TABLE A-2. EXISTING FACILITIES ORDERED BY STATE AND DESIGN TYPE (Continued)

LOCATION		COMBUSTOR	HEAT	# OF	TOTAL PLANT CAPACITY	TYPE OF	STARTUP	
CITY	STATE	TYPE	RECOVERY	COMBUSTORS	(TPD)	CONTROL(S)	DATE	REFERENCES
Center	TX	MI/SA	YES	1	36	NONE	1985	STATE OF TEXAS
Palestine	TX	MI/SA	YES	1	28	WS	NA	
Waxahachie	TX	MI/SA	YES	2	50	WS	1982	CITY CURRENTS 10/86
Ogden	UT	MB/OF	YES	3	450	ESP	NA	
Portsmouth	VA	MB/OF	YES	2	160	ESP	1971	
Norfolk (Navy Station)	VA	MB/OF	YES	2	360	ESP	1967	
Hampton	VA	MB/OF	YES	2	200	ESP	1980	
Harrisonburg	VA	MB/OF	YES	2	100	ESP	1982	
Galax	VA	MB/RC	YES	1	56	BAG	NA	CITY CURRENTS 10/86
Salem	VA	MI/SA	YES	4	100	NONE	1970	
Newport News (Ft. Eustis)	VA	MI/SA	YES	1	35	NONE	1980	
Bellingham	WA	MI/EA	YES	1	100	NONE	1986	
Bellingham	WA	MI/SA	YES	2	100	NONE	1986	
Sheboygan	WI	MB/OF	NO	2	240	WS	NA	STATE OF WISCONSIN
Waukesha	WI	MB/OF	YES	2	175	ESP	1971	
Barron County	WI	MI/SA	NO	2	80	ESP	1986	STATE OF WISCONSIN
Madison	WI	RDF/C	YES	2	400	ESP/C	1979	CITY CURRENTS 10/86

KEY

COMBUSTOR TYPES:
- MI/SA = MODULAR COMBUSTOR WITH STARVED AIR
- MI/EA = MODULAR COMBUSTOR WITH EXCESS AIR (VICON)
- RDF = REFUSE DERIVED FUEL FIRED IN DEDICATED BOILER
- RDF/C = REFUSE DERIVED FUEL/COAL COFIRING
- MB/OF = MASS BURN WITH OVERFEED STOKER
- MB/RC = MASS BURN IN ROTARY COMBUSTOR

TYPES OF CONTROLS:
- C = CYCLONE
- ESP = ELECTROSTATIC PRECIPITATOR
- WS = WET SCRUBBER
- DS = DRY SCRUBBER
- VWS = VENTURI WET SCRUBBER
- BAG = BAGHOUSE
- EGB = ELECTROSTATIC GRAVEL BED

NA = DATA NOT AVAILABLE OR TECHNOLOGY UNDECIDED

TABLE A-3. HUMAN EXPOSURE MODEL INPUTS FOR MWC FACILITIES

FILE: MUNICIPAL WASTE COMBUSTORS - NONHEAT REC - MODULAR

NAME	CITY,STATE	BASELINE STACK HEIGHT (meters)	BASELINE STACK DIAM. (meters)	BASE. GAS VELOC./STACK (meters/sec)	BASE. STACK GAS TEMP. (K)	1)STARVED AIR 2)EXCESS AIR 3)REF.SLUDGE	HEAT RECOVERY (Y/N)	No. OF INCIN.	INDIVIDUAL CAPACITY (tons/day)	TOTAL CAPACITY (tons/day)	OPERATING TIME (days/week)	BASELINE CONTROLS*	NO. OF STACKS	BASE. UNCONT. PART. EM. RATE (kg/yr)	BASE. ASSUMED CONTROL EFF. (%)	BASE. CONT. TO PART. EM. RATE (kg/yr)
Blytheville	Blytheville, AR	16.8	1.2	7.81	420	1	N	2	35	70	4	0	1	15320	0	15320
Hope	Hope, AR	19.8	0.9	7.34	420	1	N	5	12.5	37.5	1.3	0	1	2670	0	2670
Hot Springs	Hot Springs, AR	18.2	1.2	1.38	420	1	N	8	12.5	100	6	0	8	32830	0	32830
Stuttgart	Stuttgart, AR	10.7	0.8	9.29	420	1	N	3	12.5	37	4	0	1	8100	0	8100
Harpswell	Harpswell', ME	6.1	0.9	2.88	420	1	N	1	14	14	5	0	1	3830	0	3830
Auburn	Auburn, NH	15.2	0.6	2.36	420	1	N	1	5	5	3	0	1	820	0	820
Candia	Candia, NH	7.6	0.6	6.49	420	1	N	1	15	15	1	0	1	820	0	820
Canterbury	Canterbury, NH	9.1	0.9	2.1	420	1	N	1	10	10	2	0	1	1090	0	1090
Litchfield	Litchfield, NH	15.2	0.9	4.46	420	1	N	1	22.8	22.8	0.5	0	1	620	0	620
Meredith	Meredith, NH	24.4	0.9	11.1	830	1	N	2	15.6	31.2	7	0	2	12125	0	12125
Nottinghan	Nottinghan, NH	7.6	1.8	0.2	420	1	N	1	8	8	2	0	1	880	0	880
Pittsfield	Pittsfield, NH	7.6	0.6	21.23	420	1	N	1	48	48	1.3	0	1	3410	0	3410
Milton	Milton, NH	15.2	0.6	13.56	420	1	N	1	30	30	2	0	1	3280	0	3280
Wolfeboro	Wolfeboro, NH	18.3	0.6	16.51	420	1	N	2	8	16	2	0	1	2000	0	2000
Shaneatoless	Shaneatoless, KY	11.0	1	1.91	420	1	N	1	12.5	12.5	4	0	1	4100	0	4100
Brightsville Beach	Brightsville Beach, NC	9.1	0.6	6.78	420	1	N	2	15	30	7	0	2	11490	0	11490

*Controls Key: 1=esp, 2=baghouse, 3=venturi, 4=cyclone, 5=wet scrubber
6=electrified gravel bed, 7=lo-baghouse, 8=lo-wet scrubber
9=lo-ESP, 10=hi-ESP, 11=dry scrubber

TABLE A-3. HUMAN EXPOSURE MODEL INPUTS FOR MWC FACILITIES (Continued)

FILE: MUNICIPAL WASTE COMBUSTORS - HEAT RECOVERY - MODULAR

NAME	CITY,STATE	BASELINE STACK HEIGHT (meters)	BASELINE STACK DIAM. (meters)	BASE. GAS VELOC./STACK (meters/sec)	BASE. STACK GAS TEMP. (K)	1)STARV.AIR 2)EXCESS AIR 3)REF.SLUDGE	HEAT RECOVER (Y/N)	NO. OF INCIN.	INDIVIDUAL CAPACITY (tons/day)	TOTAL CAPACITY (tons/day)	OPERATING TIME (days/week)	BASELINE CONTROLS*	NO. OF STACKS	BASE. UNCONT. PART. EM. RATE (kg/yr)	BASE. ASSUMED CONTROL EFF. (%)	BASE. CONT. TO PART. EM. RATE (kg/yr)
Huntsville**	Huntsville,AL	38.1	1.2	5.46	420	1	Y	3	16.6	49.8	3.8	0	1	10360	0	10360
Tuscaloosa	Tuscaloosa, AL	25	1.2	37.6	503	1	Y	4	80	320	5	9	1	54620	28	39340
Sitka	Sitka, AK	24.4	1	4.03	420	1	Y	2	25	50	5	1	2	13680	90	1368
N. Little Rock	N. Little Rock,AR	18.3	1.2	9.29	473	1	Y	4	25	100	5	0	1	35734	0	35734
Osceola	Osceola, AR	9.1	1.2	5.6	420	1	Y	2	25	50	5	0	1	13680	0	13680
Batesville	Batesville, AR	24.3	1.8	2.49	420	1	Y	1	50	50	5	0	1	13680	0	13680
Windham	Windham, CT	17.7	1.1	14.16	420	1	Y	3	36	108	7	7	1	41370	50	20685
Mayport Naval	Mayport, FL	30.5	1.4	3.9	496	1	Y	1	48	48	5	4	1	13130	20	10504
Burley	Heyburn, ID	27.4	0.9	9.96	420	1	Y	2	25	50	5	0	1	13680	0	13680
Simpson Co	Franklin, KY	21	0.91	7.9	493	1	Y	2	38.5	77	7			14600	0	14600
Auburn	Auburn, ME	18.3	1.2	5.31	419	1	Y	4	50	200	7	7	2	76610	50	38305
Pittsfield	Pittsfield, MA	22.9	1.1	27.5	474	1	Y	3	240	720	7	6	1	440294	90	44029
Collegeville	Collegeville, MN	36.6	3.6	0.67	350	1	Y	1	55	55	7	6	1	21078	90	2107
Purhas	Purhas, MN	12.2	0.6	16.7	400	1	Y	4	20	80	7	7		21300	0	21300
Red Wing	Red Wing, MN	15.2	1.2	15.92	420	1	Y	2	36	72	5	1	1	22990	90	2299
Savage	Savage, MN	19.8	1.3	8.6	505		Y	1	80	80	7	1	1	305843	90	30584.3
Pascagoula	Pascagoula, MS	23.8	0.9	29.62	420	1	Y	2	75	150	7	9	1	57460	50	28730
Ft. Leonard Wood	Ft. Leonard Wood, MO	15.2	0.6	17.69	420	1	Y	3 (2/line)	20	40	7	0	1	15320	0	15320
Livingston	Livingston, NY	5	1.8	3.47	420	1	Y	2	70	70	5	0	1	19150	0	19150
Durhas	Durhas, NH	35.1	1.8	11.54	455	1	Y	3	36	108	7	4	1	41370	20	33096
Groveton	Groveton, NH	4.9	1.4	1.95	420	1	Y	1	24	24	3.3	0	1	4330	0	4330
Portsmouth	Portsmouth, NH	3.7	0.9	16.25	437	1	Y	4	50	200	7	7	1	76610	50	38305
Cuba	Cattaraugus Co., NY	15.2	0.6	49.56	420	1	Y	3	37.5	112.5	7	0	1	43090	0	43090
Oneida Co.	Rome, NY	38.1	0.8	37.49	420	1	Y	4	50	200	7	1	1	63700	90	6370
Oswego Co.	Fulton,NY	42.7	0.6	22.12	420	1	Y	4	50	200	7	1	4	76610	90	7661
Miami	Miami, OK	15.2	0.6	31.85	420	1	Y	3	36	108	5	0	1	24600	0	24600
Hampton	Hampton, SC	13.6	0.91	17.3	433		Y	3	90	270	7			637000	90	63700
Wellman Indus.	Johnsonville, SC	9.1	2.1	1.83	420	1	Y	1	50	50	7	0	1	19150	0	19150
Dyersburg	Dyersburg, TN	15.2	0.6	36.57	527	1	Y	1	82	82	7	0	1	31410	0	31410
Lewisburg	Lewisburg, TN	15.3	1.2	6.63	350	1	Y	1	60	60	5	8	1	16420	20	13136
Gatesville	Gatesville, TX	6.1	1	1.06	420	1	Y	1	7	7	3	0	1	1150	0	1150
Carthage City	Carthage City, TX	16.4	0.61	16.4	533	1	Y	1	40	40	7	0		7490	0	7490
Center	Center, TX	16.4	0.61	16.4	533	1	Y	1	40	40	7	0		7490	0	7490
Cleburne	Cleburne, TX	15.2	0.91	17.1	522	1	Y	3		115	7	1		30500	60	13100
Palestine	Palestine, TX	15.24	0.9	5.5	350	1	Y	1	28	28	5	8	1	7660	20	6128
Waxahachie	Waxahachie, TX	27.4	0.9	11.8	350	1	Y	2	30	60	6	8	1	19700	20	15760
Ft.Eustis	Newport News, VA	15.2	0.6	13.56	420	1	Y	1	30	30	5	0	1	8210	0	8210
Salem	Salem, VA	12.2	1.2	10	400	1	Y	4	25	100	5	0	2	22590	0	22590
Bellingham	Bellingham, MA	11.0	1.1	6.21	420	1	Y	8	12.5	100	2.5	0	1	13680	0	13680
Bellingham	Bellingham, MA	15	1	8	420	1	Y	2	50	100	2.5	0	1	13680	0	13680
Barron	Barron, WI	30.3	0.91	17.9	480		Y	2	40	80	7	1		17100	90	1710

*Controls Key: 1=esp, 2=baghouse, 3=venturi, 4=cyclone, 5=wet scrubber
6=electrified gravel bed, 7=lo-baghouse, 8=lo-wet scrubber
9=lo-ESP, 10=hi-ESP, 11=dry scrubber

**facility not currently operating.

TABLE A-3. HUMAN EXPOSURE MODEL INPUTS FOR MWC FACILITIES (Continued)

FILE: MUNICIPAL WASTE COMBUSTORS - HEAT RECOVERY - MASS BURN WATERWALL

NAME	CITY,STATE	BASELINE STACK HEIGHT (meters)	BASELINE STACK DIAM. (meters)	BASE. GAS VELOC./STACK (meters/sec)	BASE. STACK GAS TEMP. (K)	1)STARV.AIR 2)EXCESS AIR 3)REF.SLUDGE	HEAT RECOVERY (Y/N)	NO. OF INCIN.	INDIVIDUAL CAPACITY (tons/day)	TOTAL CAPACITY (tons/day)	OPERATING TIME (days/week)	BASELINE CONTROLS*	NO. OF STACKS	BASE. UNCONT. PART. ER. RATE (kg/yr)	BASE. ASSUMED CONTROL EFF. (%)	BASE. CONT. TO PART. EM. RATE (kg/yr)
Pinellas Co.	Clearwater, FL	49.4	3.7	9.23	436	2	Y	3	1000	2000	7	10	1	7053060	99	70530.6
Tampa	Tampa, FL	50.0	1.8	18.3	477	2	Y	4	250	1000	7			352650	99	3526.5
Chicago NW	Chicago, IL	70	1.8	9.05	484	2	Y	4	400	1600	7	1	2	3090000	97	92600
Baltimore RESCO	Baltimore, MD	96	1.8	13.36	506	2	Y	3	720	2160	7	10	3	16204400	>99.8 (measured)	20440
North Andover	North Andover, MA	70.1	3.7	17	420	2	Y	2	750	1500	7	10	1	5289800	99	52898
Saugus RESCO	Saugus, MA	54.3	3.7	17	420	2	Y	2	750	1500	7	10	1	5289800	99	52898
Peekskill	Peekskill, NY	59.5	3.7	9.23	420	2	Y	3	750	2250	7	10	1	7934690	99	79346.9
New Hanover Co.	Wilmington, NC	27.4	1.5	6.95	455	1	Y	2	52	104	7	1	1	39040	90	3904
Tulsa	Tulsa, OK	[illegible]	2.1	21.4	500	2	Y	2	375	750	7	1	1	2644675	99	26447
Marion Co	Marion Co, OR	50.0	0.9	37.2	345	2	Y	2	225	550	7	2	1	1979575	99	19796
Harrisburg	Harrisburg, PA	48.8	0.6	8.26	420	3	Y	2	334	720	7	1	1	352650	90	35265
Gallatin	Gallatin, TN	24.4	1.3	6.7	446	2	Y	2	100	200	7	1	1	705310	90	70531
Nashville	Nashville, TN	38	2	7.54	420	2	Y	2	360	720	7	1	1	2539100	90	253910
Langley Field	Hampton, VA	27.4	1.2	10.47	533	2	Y	2	100	200	7	1	1	705310	90	70531
Norfolk Naval Station	Norfolk, VA	38.1	3.1	1.57	420	2	Y	2 (1/line)	100	360	7	1	1	1270000	90	127000
Norfolk Naval Shipyard	Portsmouth, VA	15.2	0.6	8.26	420	2	Y	2 (1/line)	80	160	5	1	1	403000	90	40300

*Control Key: 1=esp, 2=baghouse, 3=venturi, 4=cyclone, 5=wet scrubber
6=electrified gravel bed, 7=lo-baghouse, 8=lo-wet scrubber
9=lo-ESP, 10=hi-ESP, 11=dry scrubber

TABLE A-3. HUMAN EXPOSURE MODEL INPUTS FOR MWC FACILITIES (Continued)

FILE: MUNICIPAL WASTE COMBUSTORS - HEAT RECOVERY - MASSBURN REFACTORY

NAME	CITY,STATE	BASELINE STACK HEIGHT (meters)	BASELINE STACK DIAM. (meters)	BASE. GAS VELOC./STACK (meters/sec)	BASE. STACK GAS TEMP. (K)	1)STARV.AIR 2)EXCESS AIR 3)REF.SLUDGE	HEAT RECOVERY (Y/N)	NO. OF INCIN.	INDIVIDUAL CAPACITY (tons/day)	TOTAL CAPACITY (tons/day)	OPERATING TIME (days/week)	BASELINE CONTROLS*	NO.OF STACKS	BASE. UNCONT. PART. EM. RATE (kg/yr)	BASE. ASSUMED CONTROL EFF. (%)	BASE. CONT. TO PART. EM. RATE (kg/yr)
Susanville**	Susanville, CA	10.7	0.5	11.89	420	2	Y	1	96	96	7	2	1	338550	99	3385.5
Stanford	Stanford, CT	15.2	0.9	18.61	420	2	Y	1	200	200	6	1	1	909000	90	90900
		19.1	0.9	13.8	548		Y	1	360	360	6	1	1	1640000	90	164000
Betts Ave	Queens, NY	60.0	3.4	2.6	420	3	Y	4	250	1000	7	1		5840000	90	584000
Ogden	Ogden, UT	45.7	1.5	13.4	477	2	Y	3	150	450	6	1	1	1360230	90	136023
Galax	Galax, VA	18.0	1.5	10	420	2	Y	1	55	55	7					78000
Harrisonburg	Harrisonburg, VA	48.8	0.6	8.26	420	2	Y	2	50	100	7	1	1	352650	90	35265
Waukesha	Waukesha, WI	32	2.1	9.15	420	2	Y	2		175	2	1	1	176330	90	17633

*Controls Key: 1=esp, 2=baghouse, 3=venturi, 4=cyclone, 5=wet scrubber
6=electrified gravel bed, 7=lo-baghouse, 8=lo-wet scrubber
9=lo-ESP, 10=hi-ESP, 11=dry scrubber

TABLE A-3. HUMAN EXPOSURE MODEL INPUTS FOR MWC FACILITIES (Continued)

FILE: MUNICIPAL WASTE COMBUSTORS - HEAT RECOVERY - RDF8

NAME	CITY,STATE	BASELINE STACK HEIGHT (meters)	BASELINE STACK DIAM. (meters)	BASE. GAS VELOC./STACK (meters/sec)	BASE. STACK GAS TEMP. (K)	1)STARV.AIR 2)EXCESS AIR 3)REF.BLUDGE	HEAT RECOVERY (Y/N)	NO. OF INCIN.	INDIVIDUAL CAPACITY (tons/day)	TOTAL CAPACITY (tons/day)	OPERATING TIME (days/week)	BASELINE CONTROLS*	NO. OF STACKS	BASE. UNCONT. PART. EM. RATE (kg/yr)	BASE. ASSUMED CONTROL EFF. (%)	BASE. CONT. TO PART. EM. RATE (kg/yr)
Dade County	Dade Co.,FL	91.4	1.9	45.6	450	0	Y	4	750	3000	7	1		31900000	99	319000
Lakeland	Lakeland, FL	61	3.7	1.3	400	3	Y	3	300	350	7			1029000	90	102900
Miami**	Miami, FL	46	3.1	11.26	420	2	Y	4	750	3000	7	1	1	10579590	90	1057959
Ames	Ames, IA	61	2.4	1.3	505	2	Y	1	200	200	7	1/4		2160000	80	137200
Lawrence	Haverhill, MA	99.1	2.1	19	435	3	Y	3	320	1300	7	6		6590000	99	65856
Duluth	Duluth, MN	30.5	1.1	6.9	350	3	N	2		400	7	3	2	1372000	90	137200
Albany	Albany, NY	61	2.4	14.3	472	unk	Y	1	600	600	7	1	1	2572500	97	85800
Niagra Falls	Niagra Falls, NY	70	3.7	9.23	565	2	Y	2	1070	2140	7	10	1	7566770	99	75467.7
Akron	Akron, OH	61	2.4	1.31	505	2	Y	3	65	195	7	1	2	687670	90	68767
Columbus	Columbus, OH	91.4	1.8	3.1	420	2	Y	6	166.7	1000	7	1	3	3526530	90	352653
Wright Patterson AFB**	Dayton, OH	27	2.2	8	415	2		1				4/1				
Madison** (mad.gas+electric)	Madison, WI	75.8	2.7	14.7	416	2	Y	1	144	144	7	1	1	215800	90	21580
Madison** (Oscar Meyer)	Madison, WI	63	2.3	13.7	489	2	Y	1	120	120	7	4	1	113000	50	56500

*Controls Key: 1=esp, 2=baghouse, 3=venturi, 4=cyclone, 5=wet scrubber
6=electrified gravel bed, 7=lo-baghouse, 8=lo-wet scrubber
9=lo-ESP, 10=hi-ESP, 11=dry scrubber

**Facility not currently operating.

TABLE A-3. HUMAN EXPOSURE MODEL INPUTS FOR MWC FACILITIES (Continued)

FILE: MUNICIPAL WASTE COMBUSTORS - NONHEAT REC - CONVENT.

NAME	CITY,STATE	BASELINE STACK HEIGHT (meters)	BASELINE STACK DIAM. (meters)	BASE. GAS VELOC./STACK (meters/sec)	BASE. STACK GAS TEMP. (K)	1)STARVED AIR 2)EXCESS AIR 3)REF.SLUDGE	HEAT RECOVERY (Y/N)	NO.OF INCIN.	INDIVIDUAL CAPACITY (tons/day)	TOTAL CAPACITY (tons/day)	OPERATING TIME (days/week)	BASELINE CONTROLS*	NO. OF STACKS	BASE. UNCONT. PART. EM. RATE (kg/yr)	BASE. ASSUMED CONTROL EFF. (%)	BASE. CONT. TO PART. EM. RATE (kg/yr)
Ansonia**	Ansonia, CT	15.0	0.91	10	422	2	N	1	150	150	7	5		565760	70	212000
New Canaan	New Canaan, CT	24.4	1.5	9.75	350	3	N	1	108	108	1	3	1	88845	80	11769
Washington	Washington, DC	48.8	5.5	2.09	420	2	N	4	250	1000	7	1	2	4231840	95	212000
Honolulu	Honolulu, HA	53.3	3.7	9.23	420	2	N	1	600	600	7	2		2730000	90	273000
East Chicago	East Chicago, IN	22.9	1.6	11.78	350	2	N	2	225	450	3.8	3	1	861480	80	172296
Louisville	Louisville, KY	61	4.3	0.82	350	2	N	4	225	1000	7	5	2	1586940	70	476082
Shreveport	Shreveport, LA	15.3	1.8	4.65	350	2	N	1	200	200	5	3	1	503790	80	100758
Baltimore	Baltimore, MD	51.2	2.5	18.64	517	2	N	4	300	1200	6	10	1	1370903	97.3 (measured)	37440
Pulaski		39.6	2.5	18.64	517	2	N	2	300	600	5	5	1	604550	70	181365
Fall River	Fall River, MA	27.4	1.8	1.71	350			(1/tie					1			
		21.3	1.8	1.71	350								1	544090	99	5440.9
Framingham	Framingham, MA	30.5	2.1	21.18	446	2	N	2	250	500	6	2		3188640	90	318864
Grosse Pointe	Clinton, MI	60.6	3.5	20.2	533	2	N	2	300	600	7	1		3188640	90	318864
SE Oakland County	SE Oakland Co., MI	53	3.5	27.1	347	2	N	2	300	600	7	3		3188640	90	318864
Huntington	Huntington, NY	38.1	2.13	12.1	494	2	N	3	150	450	5	8	2	68515	20	54812 (measured)
		40	2.44	12.1	494							1	1			
NYC**	Brooklyn, NY	60.1	1.5	13.4	420	2	N	1	750	750	7	1	1	2644900	90	264490
41st St. NYC	Brooklyn, NY	60.1	1.5	13.4	420	2	N	1	1000	1000	7	1	1	3526530	90	352653
N. Henry St. NYC	Brooklyn, NY	60.1	3.4	2.61	420	2	N	3	250	750	7	1	1	2644900	90	264490
SW. Brooklyn						3	Y	1	250	250	7	10	1	1123500	99	11235
NYC Queens	Glen Cove	61.0	3.7	1.3	408	2	N	4	125	1450	5	5	2	1259480	70	377844
Oyster Bay**	Syosset, NY	44.2	2.1	1.71	420	2	N	2	300	600	7	1	1	2115920	90	211592
N. Dayton	Dayton, OH	38.1	1.5	13.4	420	2	N	2	300	600	7	1	1	2115920	90	211592
S. Dayton	Dayton, OH	38.1	1.5	13.4	420	2	N	1	200	200	7	1		756000	50	355000
Euclid	Euclid, OH	37.9	0.8	7.3	505	2	N	2	375	750	7	1	1	2644900	90	264490
Philadelphia	Philadelphia, PA	30.4	2.1	24.55	420											
East Central Philadelphia	Philadelphia, PA	21.3	3	22.87	450	2	N	2	375	750	7	1	1	2644900	90	264490
Northwest																
St. Louis	St. Louis, MO	52.3	3	1.21	420	4	N	4	200	790	7	5	1	1050000	50	524800
City of Chilton**	Chilton, WI	22.7	2	2	350	2	N	1	84	84	7	8	1	318900	20/30	222900
Sheyboygan	Sheyboygan, WI	53.3	3.7	1.1	350	2	N	2	120	240	5	8	1	377840	20	302272

*Controls Key: 1=esp, 2=baghouse, 3=venturi, 4=cyclone, 5=wet scrubber
6=electrified gravel bed, 7=lo-baghouse, 8=lo-wet scrubber
9=lo-ESP, 10=hi-ESP, 11=dry scrubber

**Facility not currently operating.

APPENDIX B

PLANNED MWC FACILITIES

This appendix contains a listing of MWC facilities in the construction/permitting/planning stages. The data are based on information provided by EPA regional offices and trade journals. Although every effort was made to make this list as complete as possible, some facilties may not included.

Several facilities shown here have projected startup dates of 1986. These facilities are not included in the existing facilities list because it could not be confirmed that they had actually started operating.

The population in this appendix is also shown aggregated by design type and capacity (Table B-1) and aggregated by state and design type (Table B-2).

TABLE B-1. PLANNED FACILITIES ORDERED BY DESIGN TYPE AND SIZE

LOCATION		COMBUSTOR	HEAT	TOTAL PLANT CAPACITY	STARTUP	STATUS	CONTROL	
CITY	STATE	TYPE	RECOVERY	(TPD)	DATE	CODE	STATUS	REFERENCES
WILLISTON	ND	MB/OF	YES	100	NA	3	NA	CITY CURRENTS 10/86
MIFFLIN COUNTY (LEWISTOWN)	PA	MB/OF	YES	100	NA	1	NA	McILVANE 5/86
LOWER LUZERNE COUNTY	PA	MB/OF	YES	100	NA	1	NA	EPA REGION III SUBMITTAL
UKIAH	CA	MB/OF	YES	100	1987	2	NA	CITY CURRENTS 10/86
FAYETTEVILLE	AR	MB/OF	YES	150	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
CENTRAL BUCKS	PA	MB/OF	YES	150	NA	1	NA	EPA REGION III SUBMITTAL
MONROE CO.(KEY WEST)	FL	MB/OF	YES	150	1987	4	ESP	STATE OF FLORIDA
CHARLOTTE	NC	MB/OF	YES	200	NA	2	NA	STATE OF NORTH CAROLINA
LONG BEACH	NY	MB/OF	YES	200	1988	4	ESP	STATE OF NEW YORK
DOWNEY	CA	MB/OF	YES	200	NA	3	NA	McILVANE 5/86
UPPER BUCKS	PA	MB/OF	YES	200	NA	1	NA	EPA REGION III SUBMITTAL
SOUTHWEST BUCKS	PA	MB/OF	YES	200	NA	1	NA	WASTE TO ENERGY 12/85
CLAREMONT	NH	MB/OF	YES	200	1987	4	NA	CITY CURRENTS 10/86
JACKSON COUNTY	MI	MB/OF	YES	200	1987	3	DS/BH	McILVANE 5/86
HANOVER BOROUGH	PA	MB/OF	YES	200	NA	1	NA	EPA REGION III SUBMITTAL
ST. LAWRENCE COUNTY	NY	MB/OF	YES	225	1989	3	NA	CITY CURRENTS 10/86
MIDDLETOWN	CT	MB/OF	YES	230	1989	4	DS/BG	McILVANE 5/86
MERCER COUNTY	PA	MB/OF	YES	250	NA	1	NA	WASTE TO ENERGY 10/23/85
CITY OF COMMERCE (LOS ANGELES CO.)	CA	MB/OF	YES	300	1987	4	NA	CITY CURRENTS 10/86
CAPE MAY	NJ	MB/OF	YES	300	1990	1	NA	McILVANE 5/86
LEWISTON	ME	MB/OF	YES	300	NA	1	NA	McILVANE 5/86
MONTGOMERY COUNTY	OH	MB/OF	YES	300	1987	4	NA	CITY CURRENTS 10/86
VISALIA	CA	MB/OF	YES	350	1990	1	NA	SCAMD SUBMITTAL
WATERBURY	CT	MB/OF	YES	360	1989	1	NA	EPA REGION VII SUBMITTAL
SOUTH GATE (LOS ANGELES)	CA	MB/OF	YES	375	1990	1	NA	McILVANE 5/86
CONCORD	NH	MB/OF	YES	400	1987	3	NA	McILVANE 5/86
ESCAMBIA	FL	MB/OF	YES	400	NA	3	NA	STATE OF FLORIDA
SANTA CLARA	CA	MB/OF	YES	400	NA	3	NA	McILVANE 5/86
HUDSON FALLS (WASHINGTON COUNTY)	NY	MB/OF	YES	400	1988	3	DS/ESP	CITY CURRENTS 10/86
WARREN COUNTY	NJ	MB/OF	YES	400	1988	4	NA	CITY CURRENTS 10/86
OKALOOSA	FL	MB/OF	YES	450	NA	1	NA	STATE OF FLORIDA
SAVANNAH	GA	MB/OF	YES	500	1987	4	NA	CITY CURRENTS 10/86
AUGUSTA (BATH/BRUNSWICK & AUGUSTA)	ME	MB/OF	YES	500	1989	4	NA	CITY CURRENTS 10/86
PENNSAUKEN	NJ	MB/OF	YES	500	1989	3	NA	McILVANE 5/86
PORTLAND	ME	MB/OF	YES	500	1988	4	ESP/AG	CITY CURRENTS 10/86
BROOME COUNTY	NY	MB/OF	YES	500	1991	3	NA	McILVANE 5/86
AUSTIN	TX	MB/OF	YES	550	1989	3	NA	McILVANE 5/86, WASTE AGE 11/86
GLOUCESTER COUNTY	NJ	MB/OF	YES	575	1989	2	NA	CITY CURRENTS 10/86
PRESTON	CT	MB/OF	YES	600	1990	3	NA	SCAMD SUBMITTAL
CHARLESTON	SC	MB/OF	YES	600	1988	3	NA	McILVANE 5/86, WASTE AGE 11/86
FRESNO COUNTY	CA	MB/OF	YES	600	NA	3	NA	U.S. EPA
ONTARIO CO.(WESTERN FINGER LAKES)	NY	MB/OF	YES	600	NA	1	NA	STATE OF NEW YORK
BRISTOL	CT	MB/OF	YES	650	1988	4	DS/BG	CITY CURRENTS 10/86
HOLYOKE	MA	MB/OF	YES	685	1989	3	AG	McILVANE 5/86
HUNTSVILLE	AL	MB/OF	YES	690	1989	4	NA	CITY CURRENTS, 10/86
QUONSET INDUSTRIAL PK	RI	MB/OF	YES	710	1990	4	NA	CITY CURRENTS 10/86
ATLANTIC CO.(LITTLE EGG HARBOR)	NJ	MB/OF	YES	750	1990	3	NA	McILVANE 5/86, WASTE AGE 11/86
LOWELL	MA	MB/OF	YES	750	NA	1	NA	U.S. EPA
BABYLON	NY	MB/OF	YES	750	1988	4	DS/BH	CITY CURRENTS 10/86

TABLE B-1. PLANNED FACILITIES ORDERED BY DESIGN TYPE AND SIZE (Continued)

LOCATION		COMBUSTOR	HEAT	TOTAL PLANT CAPACITY	STARTUP	STATUS	CONTROL	
CITY	STATE	TYPE	RECOVERY	(TPD)	DATE	CODE	STATUS	REFERENCES
HUNTINGTON	NY	MB/OF	YES	750	1990	2	NA	STATE OF NEW YORK
NEW MILFORD	CT	MB/OF	YES	750	NA	1	NA	WASTE TO ENERGY
SOUTH BRONX	NY	MB/OF	YES	800	NA	3	BH/S	McILVANE 5/86
PORTSMOUTH	NH	MB/OF	YES	800	NA	3	BH	McILVANE 5/86, WASTE AGE 11/86
STANISLAUS COUNTY	CA	MB/OF	YES	800	1989	4	NA	CITY CURRENTS 10/86
WAYNE CO.(DEARBON HEIGHTS)	MI	MB/OF	YES	800	NA	1	NA	McILVANE 5/86, WASTE AGE 11/86
LONG BEACH, STAGE I	CA	MB/OF	YES	920	1988	4	NA	WASTE AGE
ALEXANDRIA/ARLINGTON	VA	MB/OF	YES	975	1987	4	NA	CITY CURRENTS 10/86
SPOKANE COUNTY	WA	MB/OF	YES	1000	1990	2	NA	McILVANE 5/86
CAMDEN COUNTY	NJ	MB/OF	YES	1000	1989	3	NA	McILVANE 5/86
LOS ANGELES CO. (SPADRA)	CA	MB/OF	YES	1000	NA	1	NA	CWMB
NORTH HEMPSTEAD	NY	MB/OF	YES	1000	1990	2	NA	STATE OF NEW YORK
LANCASTER COUNTY	PA	MB/OF	YES	1000	1990	1	NA	EPA REGION III SUBMITTAL
YORK COUNTY	PA	MB/OF	YES	1000	1989	1	NA	EPA REGION III SUBMITTAL
OCEAN CO.	NJ	MB/OF	YES	1000	1992	0	NA	McILVANE 5/86, WASTE AGE 11/86
HOWARD CO.(BALTIMORE)	MD	MB/OF	YES	1000-1500	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
LEHIGH VALLEY	PA	MB/OF	YES	1050	1989	3	NA	EPA REGION III SUBMITTAL
PASCO CO.	FL	MB/OF	YES	1200	NA	1	NA	STATE OF FLORIDA
GARDENA	CA	MB/OF	YES	1200	1991	3	NA	U.S. EPA
CHESTER	PA	MB/OF	YES	1200	1988	3	NA	EPA REGION III SUBMITTAL
HENNEPIN COUNTY (MINNEAPOLIS)	MN	MB/OF	YES	1200	1989	4	BH/AG	CITY CURRENTS 10/86
HILLSBOROUGH COUNTY	FL	MB/OF	YES	1200	1987	4	ESP	CITY CURRENTS 10/86
PORTLAND	OR	MB/OF	YES	1200	1990	1	NA	McILVANE 5/86
BERKS COUNTY	PA	MB/OF	YES	1200	1988	1	NA	McILVANE 5/86
MONTGOMERY COUNTY	PA	MB/OF	YES	1200	1989	4	NA	CITY CURRENTS 10/86
EPHRATA BOROUGH	PA	MB/OF	YES	1250	1990	1	NA	EPA REGION III SUBMITTAL
LONG BEACH, STAGE II	CA	MB/OF	YES	1350	NA	3	NA	SCAMD SUBMITTAL
ONONDAGA COUNTY (SYRACUSE)	NY	MB/OF	YES	1400	NA	2	NA	WASTE AGE 11/86
PASSAIC COUNTY	NJ	MB/OF	YES	1400	1989	3	NA	McILVANE 5/86
HOUSTON (PASADENA)	TX	MB/OF	YES	1500	1990	3	NA	WASTE AGE
BRISBANE	CA	MB/OF	YES	1500	NA	1	NA	
SNOHOMISH COUNTY	WA	MB/OF	YES	1500	1992	1	NA	WASTE TO ENERGY 9/25/85
DELAWARE COUNTY (RESOURCE REC. 2)	PA	MB/OF	YES	1500	NA	1	NA	McILVANE 5/86
MILLBURY	MA	MB/OF	YES	1500	1988	4	ESP/AG	CITY CURRENTS, 10/86
HUDSON COUNTY	NJ	MB/OF	YES	1500	1989	3	NA	McILVANE 5/86
DORCHESTER	MA	MB/OF	YES	1500-1800	NA	1	ESP/DS	U.S. EPA
LANCER (LOS ANGELES)	CA	MB/OF	YES	1600	1989	3	NA	U.S. EPA
OYSTER BAY	NY	MB/OF	YES	1650	1989	4	ESP	McILVANE 5/86
SAN MARCOS (SAN DIEGO CO.)	CA	MB/OF	YES	1672	1989	4	NA	CITY CURRENTS 10/86
MONTGOMERY CO.	MD	MB/OF	YES	1800	NA	1	NA	McILVANE 5/86, WASTE AGE 11/86
LOS ANGELES CO. (PUENTE HILLS E)	CA	MB/OF	YES	2000	NA	2	NA	WASTE AGE
PLAINVILLE	MA	MB/OF	YES	2000	NA	1	NA	U.S. EPA
LOS ANGELES CO. (PUENTE HILLS W)	CA	MB/OF	YES	2000	NA	2	NA	CWMB
PHILADELPHIA (SOUTH)	PA	MB/OF	YES	2200	NA	1	NA	McILVANE 5/86
BUCKS COUNTY (FALLS TOWNSHIP)	PA	MB/OF	YES	2200	NA	1	NA	McILVANE 5/86
ESSEX COUNTY	NJ	MB/OF	YES	2250	1989	4	ESP/S	CITY CURRENTS 10/86
HEMPSTEAD	NY	MB/OF	YES	2250	1989	2	DS/ESP	CITY CURRENTS 10/86
SAN DIEGO (SANDER)	CA	MB/OF	YES	2250	1989	2	NA	CITY CURRENTS 10/86
BRIDGEPORT	CT	MB/OF	YES	2250	1988	4	DS/BG	CITY CURRENTS 10/86

TABLE B-1. PLANNED FACILITIES ORDERED BY DESIGN TYPE AND SIZE (Continued)

LOCATION		COMBUSTOR	HEAT	TOTAL PLANT CAPACITY	STARTUP	STATUS	CONTROL	
CITY	STATE	TYPE	RECOVERY	(TPD)	DATE	CODE	STATUS	REFERENCES
INDIANAPOLIS	IN	MB/OF	YES	2360	1989	4	NA	CITY CURRENTS 10/86
JACKSONVILLE (DUVAL COUNTY)	FL	MB/OF	YES	2700	1990	1	NA	STATE OF FLORIDA
CARTERET	NJ	MB/OF	YES	3000	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
NEW YORK (BROOKLYN NAVY YARD)	NY	MB/OF	YES	3000	1989	2	DS/BH	WASTE TO ENERGY 10/23/85
BERGEN COUNTY	NJ	MB/OF	YES	3000	1990	4	NA	CITY CURRENTS 10/86
IRWINDALE	CA	MB/OF	YES	3000	1989	3	NA	McILVANE 5/86
SKAGET COUNTY	WA	MB/RC	YES	150	1988	2	NA	WASTE AGE
BLOOMINGTON	IN	MB/RC	YES	370	1988	4	NA	CITY CURRENTS 10/86
GREENSBORO	NC	MB/RC	YES	400	NA	2	NA	STATE OF NORTH CAROLINA
DUTCHESS COUNTY	NY	MB/RC	YES	400	1987	4	BH	CITY CURRENTS 10/86
SANGER	CA	MB/RC	YES	500	1987	2	NA	McILVANE 5/86
LUBBOCK	TX	MB/RC	YES	500	1987	3	NA	McILVANE 5/86
PANAMA CITY (BAY COUNTY)	FL	MB/RC	YES	510	1987	4	ESP	CITY CURRENTS 10/86
ISLIP	NY	MB/RC	YES	518	1988	4	ESP	EPA REGION IV SUBMITTAL
ST. LOUIS	MO	MB/RC	YES	600	1989	3	NA	CITY CURRENTS 10/86, CITY OF ST. LOUIS
JOHNSTON	RI	MB/RC	YES	710	NA	3	NA	STATE OF RHODE ISLAND
WOONSOCKET	RI	MB/RC	YES	710	NA	3	NA	STATE OF RHODE ISLAND
VENTURA COUNTY	CA	MB/RC	YES	1000	NA	0	NA	U.S. EPA
SAN JUAN	PR	MB/RC	YES	1000	NA	1	NA	McILVANE 5/86
WILMINGTON	CA	MB/RC	YES	2000	1988	4	NA	McILVANE 5/86
RUTLAND	VT	MI/EA	YES	240	1987	4	ESP	CITY CURRENTS 10/86
SPRINGFIELD (AGAWAM)	MA	MI/EA	YES	360	1988	3	DS/BH/AG	McILVANE 5/86
WEBSTER	MA	MI/EA	YES	360	1989	4	NA	CITY CURRENTS 10/86
WALLINGFORD	CT	MI/EA	YES	420	1988	4	DS/BG	CITY CURRENTS 10/86
MANCHESTER	NH	MI/EA	YES	450	1989	4	NA	CITY CURRENTS 10/86
FREMONT	CA	MI/EA	YES	480	1989	4	NA	CITY CURRENTS 10/86
POTTER COUNTY	PA	MI/SA	YES	25	NA	1	NA	EPA REGION III SUBMITTAL
FORT KNOX	KY	MI/SA	YES	40	NA	4	NA	McILVANE 5/86
WESTMORELAND COUNTY	PA	MI/SA	YES	50	1986	5	NA	CITY CURRENTS 10/86
JUNEAU	AK	MI/SA	YES	70	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
PERHAM	MN	MI/SA	YES	72	1986	4	ESP	McILVANE 5/86, WASTE AGE 11/86
LITCHFIELD	MI	MI/SA	YES	75	NA	0	AG	MICHIGAN APC
NANTUCKET	MA	MI/SA	YES	75	1987	0	NA	McILVANE 5/86, WASTE AGE 11/86
FORT DIX	NJ	MI/SA	YES	80	1988	4	BH/S	CITY CURRENTS 10/86
GENESEE COUNTY	NY	MI/SA	YES	100	NA	1	NA	WASTE AGE 11/86
PLEASANTON	CA	MI/SA	YES	100	NA	2	NA	McILVANE 5/86
CAMPBELLSVILLE	KY	MI/SA	YES	100	NA	1	NA	CITY CURRENTS 10/86
MUSKIGON	MI	MI/SA	YES	150	NA	4	DS/BH	MICHIGAN APC
CLINTON COUNTY (LOCKHAVEN)	PA	MI/SA	YES	200	NA	1	NA	McILVANE 5/86
ERIE COUNTY	NY	MI/SA	YES	250	NA	1	NA	EPA REGION IV SUBMITTAL
GREENE COUNTY	NY	MI/SA	YES	300	NA	1	NA	EPA REGION IV SUBMITTAL
MONROE COUNTY (EAST STRAUSBURG)	PA	MI/SA	YES	300	1987	1	NA	EPA REGION III SUBMITTAL
EDGEWOOD (HARFORD COUNTY)	MD	MI/SA	YES	360	1987	4	NA	EPA REGION III SUBMITTAL
NEW HAVEN	CT	MI/SA	YES	450	1989	4	DS/BG	McILVANE 5/86
POPE AND DOUGLAS COUNTIES	MN	NA	YES	100	NA	3	ESP	McILVANE 5/86, WASTE AGE 11/86
CONWAY	NH	NA	YES	150	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
SANTA CRUZ	CA	NA	YES	175	NA	1	NA	FRANKLIN
LYNDONVILLE	VT	NA	YES	200	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
GALVESTON	TX	NA	YES	200	1992	3	NA	McILVANE 5/86, WASTE AGE 11/86

TABLE B-1. PLANNED FACILITIES ORDERED BY DESIGN TYPE AND SIZE (Continued)

LOCATION		COMBUSTOR	HEAT	TOTAL PLANT CAPACITY	STARTUP	STATUS	CONTROL	
CITY	STATE	TYPE	RECOVERY	(TPD)	DATE	CODE	STATUS	REFERENCES
OLMSTEAD CO.	MN	NA	YES	200	NA	4	ESP	McILVANE 5/86, WASTE AGE 11/86
NORTH PENN	PA	NA	YES	200	NA	1	NA	EPA REGION III SUBMITTAL
LAKE COUNTY (PROJECT 2)	FL	NA	YES	250	1988	2	NA	McILVANE 5/86
LAKE COUNTY (PROJECT 1)	FL	NA	YES	250	1988	2	ESP	McILVANE 5/86
JEFFERSON CO.(MT. VERNON)	IL	NA	YES	300	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
HUNTERDON CO.	NJ	NA	YES	300-500	NA	0	NA	McILVANE 5/86, WASTE AGE 11/86
SARATOGA CO.	NY	NA	YES	360	NA	2	NA	McILVANE 5/86, WASTE AGE 11/86
STRATFORD	CT	NA	YES	360	1989	4	NA	CITY CURRENTS 10/86
SUSSEX CO.(LAFAYETTE)	NJ	NA	YES	400	NA	1	NA	McILVANE 5/86, WASTE AGE 11/86
DERRY	NH	NA	YES	400	1988	3	NA	McILVANE 5/86, WASTE AGE 11/86
SANGAMON CO.(SPRINGFIELD)	IL	NA	YES	450	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
DANBURY	CT	NA	YES	450	1990	0	NA	FRANKLIN
ANNE ARUNDEL CO.	MD	NA	YES	500	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
CORPUS CHRISTI	TX	NA	YES	550	NA	1	NA	McILVANE 5/86, WASTE AGE 11/86
SOMERSET CO.(BRIDGEWATER)	NJ	NA	YES	600	1988	0	NA	McILVANE 5/86, WASTE AGE 11/86
MORGANTOWN	PA	NA	YES	600-750	NA	0	NA	EPA REGION III SUBMITTAL
GRAND PRAIRIE(IRVING)	TX	NA	YES	700-800	NA	1	NA	McILVANE 5/86, WASTE AGE 11/86
YORK	PA	NA	YES	1000	1989	3	NA	McILVANE 5/86
QUEENS(MASPETH)	NY	NA	YES	1200	NA	2	NA	STATE OF NEW YORK
MANHATTAN(SHERMAN CREEK)	NY	NA	YES	1200	NA	2	NA	STATE OF NEW YORK
KNOX CO.(KNOXVILLE)	TN	NA	YES	1200	1991	1	NA	McILVANE 5/86, WASTE AGE 11/86
MERCER CO.(HAMILTON TOWNSHIP)	NJ	NA	YES	1200	NA	0	NA	McILVANE 5/86, WASTE AGE 11/86
RIVERSIDE	CA	NA	YES	1500	1990	1	NA	SCAMD SUBMITTAL
UNION CO.(RAHWAY)	NJ	NA	YES	1500	1990	0	NA	McILVANE 5/86, WASTE AGE 11/86
ALAMEDA	CA	NA	YES	1600	1989	2	NA	McILVANE 5/86
BRONX (BARRETTO POINT)	NY	NA	YES	2000	NA	2	NA	STATE OF NEW YORK
KING COUNTY	WA	NA	YES	2000	1993	1	NA	EPA REGION X
BROWARD COUNTY (NORTH)	FL	NA	YES	2200	1989	4	ESP/S	CITY CURRENTS 10/86
BROWARD COUNTY (SOUTH)	FL	NA	YES	2250	1989	4	ESP/S	CITY CURRENTS 10/86
STATEN ISLAND	NY	NA	YES	3000	NA	2	NA	STATE OF NEW YORK
FAIRFAX COUNTY	VA	NA	YES	3000	1990	2	NA	McILVANE 5/86
EDISON TOWNSHIP	NJ	NA	YES	3000	1989	1	NA	McILVANE 5/86, WASTE AGE 11/86
NORTHERN TIER SOLID WASTE AUTHORITY	PA	RDF	YES	100	NA	1	NA	CALIFORNIA WASTE MANAGEMENT SURVEY
FRANKLIN	OH	RDF	YES	150	1987	3	NA	U.S. EPA
LOS GATOS	CA	RDF	YES	200	NA	5	NA	EPA REGION IV
SOMERVILLE	MA	RDF	YES	330	NA	1	NA	U.S. EPA
TACOMA	WA	RDF	YES	500	1988	4	NA	FRANKLIN
WILMINGTON (DELAWARE SWA)	DE	RDF	YES	600	1987	4	NA	EPA REGION IV SUBMITTAL
BIDDEFORD/SACO	ME	RDF	YES	607	1987	4	AG	CITY CURRENTS 10/86
SACRAMENTO COUNTY	CA	RDF	YES	700	NA	1	NA	
BANGOR/BREWER/ORRINGTON	ME	RDF	YES	750	1988	4	BH/AG	CITY CURRENTS 10/86
ERIE	PA	RDF	YES	847	1988	2	NA	CITY CURRENTS 10/86
NAPLES (COLLIER COUNTY)	FL	RDF	YES	860	1988	4	BH	EPA REGIONAL SUBMITTAL
CONCORD	CA	RDF	YES	900	1989	1	NA	SCAMD SUBMITTAL
CONTRA COSTA COUNTY (RICHMOND)	CA	RDF	YES	900	1989	1	NA	WASTE AGE
MANKATO (1 & 2)	MN	RDF	YES	940	1987	3	ESP	McILVANE 5/86, WASTE AGE 11/86
RED WING (1 & 2)	MN	RDF	YES	940	1987	3	ESP	McILVANE 5/86, WASTE AGE 11/86
MORRIS COUNTY	NJ	RDF	YES	1000	NA	1	NA	WASTE TO ENERGY 9/25/85
NEWPORT	MN	RDF	YES	1000	1987	4	BH/AG	CITY CURRENTS 10/86

TABLE B-1. PLANNED FACILITIES ORDERED BY DESIGN TYPE AND SIZE (Continued)

LOCATION				TOTAL PLANT CAPACITY	STARTUP	STATUS	CONTROL	
CITY	STATE	COMBUSTOR TYPE	HEAT RECOVERY	(TPD)	DATE	CODE	STATUS	REFERENCES
RENO (PHASE II)	NV	RDF	YES	1000	NA	4	NA	CITY CURRENTS 10/86
MILLIKEN LANDFILL	CA	RDF	YES	1600	NA	2	NA	CWMI
SAN BERNARDINO	CA	RDF	YES	1600	1989	3	NA	McILVANE 5/86, WASTE AGE 11/86
ROCHESTER	MA	RDF	YES	1800	1989	4	ESP/AG	CITY CURRENTS 10/86
HONOLULU	HA	RDF	YES	1800	1989	4	NA	CITY CURRENTS 10/86
COMPTON	CA	RDF	YES	1800	NA	2	NA	WASTE AGE
HARTFORD	CT	RDF	YES	2000	1988	4	DS/BG	WASTE TO ENERGY
WEST PALM BEACH COUNTY	FL	RDF	YES	2000	1989	4	NA	CITY CURRENTS 10/86
AZUSA	CA	RDF	YES	2000	1989	1	NA	McILVANE 5/86
PETERSBURG	VA	RDF	YES	2400	1986	4	NA	CITY CURRENTS 10/86
DETROIT	MI	RDF	YES	3300	1988	2	NA	CITY CURRENTS 10/86
REDWOOD (SAN FRANCISCO)	CA	RDF	YES	3850	NA	3	NA	CWMI
PORTSMOUTH	VA	RDF/C	YES	2000	1987	4	NA	CITY CURRENTS 10/86
WEYMOUTH	MA	RDF/FB	YES	400	NA	1	NA	WASTE TO ENERGY 8/28/85

KEY

COMBUSTOR TYPES:
- MI/SA = MODULAR COMBUSTOR WITH STARVED AIR
- MI/EA = MODULAR COMBUSTOR WITH EXCESS AIR (VICON)
- RDF = REFUSE DERIVED FUEL FIRED IN DEDICATED BOILER
- RDF/C = REFUSE DERIVED FUEL/COAL COFIRING
- MB/OF = MASS BURN WITH OVERFEED STOKER
- MB/RC = MASS BURN IN ROTARY COMBUSTOR
- NA = DATA NOT AVAILABLE OR TECHNOLOGY UNDECIDED

STATUS CODE:
- 0 = STATUS UNKNOWN
- 1 = EARLY PLANNING STAGES
- 2 = PERMITTING STAGES
- 3 = CONTRACT AWARDED
- 4 = CONSTRUCTION UNDERWAY OR EXPECTED SOON
- 5 = TESTING STAGES

CONTROL STATUS:
- BH = BAGHOUSE
- S = WATER SCRUBBER
- ESP = ELECTROSTATIC PRECIPITATOR
- AG = ACID GAS CONROL
- DS = DRY SCRUBBER

TABLE B-2. PLANNED FACILITIES ORDERED BY STATE AND DESIGN TYPE

LOCATION		COMBUSTOR TYPE	HEAT RECOVERY	TOTAL PLANT CAPACITY (TPD)	STARTUP DATE	STATUS CODE	CONTROL STATUS	REFERENCES
CITY	STATE							
JUNEAU	AK	MI/SA	YES	70	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
HUNTSVILLE	AL	MB/OF	YES	690	1989	4	NA	CITY CURRENTS, 10/86
FAYETTEVILLE	AR	MB/OF	YES	150	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
SAN DIEGO (SANDER)	CA	MB/OF	YES	2250	1989	2	NA	CITY CURRENTS 10/86
DOWNEY	CA	MB/OF	YES	200	NA	3	NA	McILVANE 5/86
LOS ANGELES CO. (PUENTE HILLS E)	CA	MB/OF	YES	2000	NA	2	NA	WASTE AGE
LOS ANGELES CO. (PUENTE HILLS W)	CA	MB/OF	YES	2000	NA	2	NA	CWMB
SAN MARCOS (SAN DIEGO CO.)	CA	MB/OF	YES	1672	1989	4	NA	CITY CURRENTS 10/86
LOS ANGELES CO. (SPADRA)	CA	MB/OF	YES	1000	NA	1	NA	CWMB
CITY OF COMMERCE (LOS ANGELES CO.)	CA	MB/OF	YES	300	1987	4	NA	CITY CURRENTS 10/86
UKIAH	CA	MB/OF	YES	100	1987	2	NA	CITY CURRENTS 10/86
IRWINDALE	CA	MB/OF	YES	3000	1989	3	NA	McILVANE 5/86
VISALIA	CA	MB/OF	YES	350	1990	1	NA	SCAMD SUBMITTAL
BRISBANE	CA	MB/OF	YES	1500	NA	1	NA	
SOUTH GATE (LOS ANGELES)	CA	MB/OF	YES	375	1990	1	NA	McILVANE 5/86
FRESNO COUNTY	CA	MB/OF	YES	600	NA	3	NA	U.S. EPA
SANTA CLARA	CA	MB/OF	YES	400	NA	3	NA	McILVANE 5/86
STANISLAUS COUNTY	CA	MB/OF	YES	800	1989	4	NA	CITY CURRENTS 10/86
GARDENA	CA	MB/OF	YES	1200	1991	3	NA	U.S. EPA
LONG BEACH, STAGE I	CA	MB/OF	YES	920	1988	4	NA	WASTE AGE
LONG BEACH, STAGE II	CA	MB/OF	YES	1350	NA	3	NA	SCAMD SUBMITTAL
LANCER (LOS ANGELES)	CA	MB/OF	YES	1600	1989	3	NA	U.S. EPA
WILMINGTON	CA	MB/RC	YES	2000	1988	4	NA	McILVANE 5/86
VENTURA COUNTY	CA	MB/RC	YES	1000	NA	0	NA	U.S. EPA
SANGER	CA	MB/RC	YES	500	1987	2	NA	McILVANE 5/86
FREMONT	CA	MI/EA	YES	480	1989	4	NA	CITY CURRENTS 10/86
PLEASANTON	CA	MI/SA	YES	100	NA	2	NA	McILVANE 5/86
SANTA CRUZ	CA	NA	YES	175	NA	1	NA	FRANKLIN
ALAMEDA	CA	NA	YES	1600	1989	2	NA	McILVANE 5/86
RIVERSIDE	CA	NA	YES	1500	1990	1	NA	SCAMD SUBMITTAL
LOS GATOS	CA	RDF	YES	200	NA	5	NA	EPA REGION IV
SACRAMENTO COUNTY	CA	RDF	YES	700	NA	1	NA	
CONCORD	CA	RDF	YES	900	1989	1	NA	SCAMD SUBMITTAL
REDWOOD (SAN FRANCISCO)	CA	RDF	YES	3850	NA	3	NA	CWMB
SAN BERNARDINO	CA	RDF	YES	1600	1989	3	NA	McILVANE 5/86, WASTE AGE 11/86
MILLIKEN LANDFILL	CA	RDF	YES	1600	NA	2	NA	CWMB
AZUSA	CA	RDF	YES	2000	1989	1	NA	McILVANE 5/86
CONTRA COSTA COUNTY (RICHMOND)	CA	RDF	YES	900	1989	1	NA	WASTE AGE
COMPTON	CA	RDF	YES	1800	NA	2	NA	WASTE AGE
NEW MILFORD	CT	MB/OF	YES	750	NA	1	NA	WASTE TO ENERGY
MIDDLETOWN	CT	MB/OF	YES	230	1989	4	DS/BG	McILVANE 5/86
BRIDGEPORT	CT	MB/OF	YES	2250	1988	4	DS/BG	CITY CURRENTS 10/86
WATERBURY	CT	MB/OF	YES	360	1989	1	NA	EPA REGION VII SUBMITTAL
BRISTOL	CT	MB/OF	YES	650	1988	4	DS/BG	CITY CURRENTS 10/86
PRESTON	CT	MB/OF	YES	600	1990	3	NA	SCAMD SUBMITTAL
WALLINGFORD	CT	MI/EA	YES	420	1988	4	DS/BG	CITY CURRENTS 10/86
NEW HAVEN	CT	MI/SA	YES	450	1989	4	DS/BG	McILVANE 5/86
DANBURY	CT	NA	YES	450	1990	0	NA	FRANKLIN
STRATFORD	CT	NA	YES	360	1989	4	NA	CITY CURRENTS 10/86

TABLE B-2. PLANNED FACILITIES ORDERED BY STATE AND DESIGN TYPE (Continued)

LOCATION		COMBUSTOR	HEAT	TOTAL PLANT CAPACITY	STARTUP	STATUS	CONTROL	REFERENCES
CITY	STATE	TYPE	RECOVERY	(TPD)	DATE	CODE	STATUS	
HARTFORD	CT	RDF	YES	2000	1988	4	DS/BG	WASTE TO ENERGY
WILMINGTON (DELAWARE SWA)	DE	RDF	YES	600	1987	4	NA	EPA REGION IV SUBMITTAL
OKALOOSA	FL	MB/OF	YES	450	NA	1	NA	STATE OF FLORIDA
HILLSBOROUGH COUNTY	FL	MB/OF	YES	1200	1987	4	ESP	CITY CURRENTS 10/86
JACKSONVILLE (DUVAL COUNTY)	FL	MB/OF	YES	2700	1990	1	NA	STATE OF FLORIDA
PASCO CO.	FL	MB/OF	YES	1200	NA	1	NA	STATE OF FLORIDA
MONROE CO.(KEY WEST)	FL	MB/OF	YES	150	1987	4	ESP	STATE OF FLORIDA
ESCAMBIA	FL	MB/OF	YES	400	NA	3	NA	STATE OF FLORIDA
PANAMA CITY (BAY COUNTY)	FL	MB/RC	YES	510	1987	4	ESP	CITY CURRENTS 10/86
BROWARD COUNTY (SOUTH)	FL	NA	YES	2250	1989	4	ESP/S	CITY CURRENTS 10/86
BROWARD COUNTY (NORTH)	FL	NA	YES	2200	1989	4	ESP/S	CITY CURRENTS 10/86
LAKE COUNTY (PROJECT 1)	FL	NA	YES	250	1988	2	ESP	McILVANE 5/86
LAKE COUNTY (PROJECT 2)	FL	NA	YES	250	1988	2	NA	McILVANE 5/86
WEST PALM BEACH COUNTY	FL	RDF	YES	2000	1989	4	NA	CITY CURRENTS 10/86
NAPLES (COLLIER COUNTY)	FL	RDF	YES	860	1988	4	BH	EPA REGIONAL SUBMITTAL
SAVANNAH	GA	MB/OF	YES	500	1987	4	NA	CITY CURRENTS 10/86
HONOLULU	HA	RDF	YES	1800	1989	4	NA	CITY CURRENTS 10/86
SANGAMON CO.(SPRINGFIELD)	IL	NA	YES	450	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
JEFFERSON CO.(MT. VERNON)	IL	NA	YES	300	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
INDIANAPOLIS	IN	MB/OF	YES	2360	1989	4	NA	CITY CURRENTS 10/86
BLOOMINGTON	IN	MB/RC	YES	370	1988	4	NA	CITY CURRENTS 10/86
FORT KNOX	KY	MI/SA	YES	40	NA	4	NA	McILVANE 5/86
CAMPBELLSVILLE	KY	MI/SA	YES	100	NA	1	NA	CITY CURRENTS 10/86
HOLYOKE	MA	MB/OF	YES	685	1989	3	AG	McILVANE 5/86
MILLBURY	MA	MB/OF	YES	1500	1988	4	ESP/AG	CITY CURRENTS, 10/86
LOWELL	MA	MB/OF	YES	750	NA	1	NA	U.S. EPA
DORCHESTER	MA	MB/OF	YES	1500-1800	NA	1	ESP/DS	U.S. EPA
PLAINVILLE	MA	MB/OF	YES	2000	NA	1	NA	U.S. EPA
WEBSTER	MA	MI/EA	YES	360	1989	4	NA	CITY CURRENTS 10/86
SPRINGFIELD (AGAWAM)	MA	MI/EA	YES	360	1988	3	DS/BH/AG	McILVANE 5/86
NANTUCKET	MA	MI/SA	YES	75	1987	0	NA	McILVANE 5/86, WASTE AGE 11/86
SOMERVILLE	MA	RDF	YES	330	NA	1	NA	U.S. EPA
ROCHESTER	MA	RDF	YES	1800	1989	4	ESP/AG	CITY CURRENTS 10/86
WEYMOUTH	MA	RDF/FB	YES	400	NA	1	NA	WASTE TO ENERGY 8/28/85
MONTGOMERY CO.	MD	MB/OF	YES	1800	NA	1	NA	McILVANE 5/86, WASTE AGE 11/86
HOWARD CO.(BALTIMORE)	MD	MB/OF	YES	1000-1500	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
EDGEWOOD (HARFORD COUNTY)	MD	MI/SA	YES	360	1987	4	NA	EPA REGION III SUBMITTAL
ANNE ARUNDEL CO.	MD	NA	YES	500	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
AUGUSTA (BATH/BRUNSWICK & AUGUSTA)	ME	MB/OF	YES	500	1989	4	NA	CITY CURRENTS 10/86
PORTLAND	ME	MB/OF	YES	500	1988	4	ESP/AG	CITY CURRENTS 10/86
LEWISTON	ME	MB/OF	YES	300	NA	1	NA	McILVANE 5/86
BANGOR/BREWER/ORRINGTON	ME	RDF	YES	750	1988	4	BH/AG	CITY CURRENTS 10/86
BIDDEFORD/SACO	ME	RDF	YES	607	1987	4	AG	CITY CURRENTS 10/86
JACKSON COUNTY	MI	MB/OF	YES	200	1987	3	DS/BH	McILVANE 5/86
WAYNE CO.(DEARBON HEIGHTS)	MI	MB/OF	YES	800	NA	1	NA	McILVANE 5/86, WASTE AGE 11/86
LITCHFIELD	MI	MI/SA	YES	75	NA	0	AG	MICHIGAN APC
MUSKIGON	MI	MI/SA	YES	150	NA	4	DS/BH	MICHIGAN APC
DETROIT	MI	RDF	YES	3300	1988	2	NA	CITY CURRENTS 10/86
HENNEPIN COUNTY (MINNEAPOLIS)	MN	MB/OF	YES	1200	1989	4	BH/AG	CITY CURRENTS 10/86

TABLE B-2. PLANNED FACILITIES ORDERED BY STATE AND DESIGN TYPE (Continued)

LOCATION		COMBUSTOR	HEAT	TOTAL PLANT CAPACITY	STARTUP	STATUS	CONTROL	
CITY	STATE	TYPE	RECOVERY	(TPD)	DATE	CODE	STATUS	REFERENCES
PERHAM	MN	MI/SA	YES	72	1986	4	ESP	McILVANE 5/86, WASTE AGE 11/86
OLMSTEAD CO.	MN	NA	YES	200	NA	4	ESP	McILVANE 5/86, WASTE AGE 11/86
POPE AND DOUGLAS COUNTIES	MN	NA	YES	100	NA	3	ESP	McILVANE 5/86, WASTE AGE 11/86
MANKATO (1 & 2)	MN	RDF	YES	940	1987	3	ESP	McILVANE 5/86, WASTE AGE 11/86
NEWPORT	MN	RDF	YES	1000	1987	4	BH/AG	CITY CURRENTS 10/86
RED WING (1 & 2)	MN	RDF	YES	940	1987	3	ESP	McILVANE 5/86, WASTE AGE 11/86
ST. LOUIS	MO	MB/RC	YES	600	1989	3	NA	CITY CURRENTS 10/86, CITY OF ST. LOUIS
CHARLOTTE	NC	MB/OF	YES	200	NA	2	NA	STATE OF NORTH CAROLINA
GREENSBORO	NC	MB/RC	YES	400	NA	2	NA	STATE OF NORTH CAROLINA
WILLISTON	ND	MB/OF	YES	100	NA	3	NA	CITY CURRENTS 10/86
PORTSMOUTH	NH	MB/OF	YES	800	NA	3	BH	McILVANE 5/86, WASTE AGE 11/86
CLAREMONT	NH	MB/OF	YES	200	1987	4	NA	CITY CURRENTS 10/86
CONCORD	NH	MB/OF	YES	400	1987	3	NA	McILVANE 5/86
MANCHESTER	NH	MI/EA	YES	450	1989	4	NA	CITY CURRENTS 10/86
DERRY	NH	NA	YES	400	1988	3	NA	McILVANE 5/86, WASTE AGE 11/86
CONWAY	NH	NA	YES	150	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
WARREN COUNTY	NJ	MB/OF	YES	400	1988	4	NA	CITY CURRENTS 10/86
PENNSAUKEN	NJ	MB/OF	YES	500	1989	3	NA	McILVANE 5/86
ATLANTIC CO.(LITTLE EGG HARBOR)	NJ	MB/OF	YES	750	1990	3	NA	McILVANE 5/86, WASTE AGE 11/86
HUDSON COUNTY	NJ	MB/OF	YES	1500	1989	3	NA	McILVANE 5/86
GLOUCESTER COUNTY	NJ	MB/OF	YES	575	1989	2	NA	CITY CURRENTS 10/86
CARTERET	NJ	MB/OF	YES	3000	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
CAMDEN COUNTY	NJ	MB/OF	YES	1000	1989	3	NA	McILVANE 5/86
ESSEX COUNTY	NJ	MB/OF	YES	2250	1989	4	ESP/S	CITY CURRENTS 10/86
PASSAIC COUNTY	NJ	MB/OF	YES	1400	1989	3	NA	McILVANE 5/86
BERGEN COUNTY	NJ	MB/OF	YES	3000	1990	4	NA	CITY CURRENTS 10/86
OCEAN CO.	NJ	MB/OF	YES	1000	1992	0	NA	McILVANE 5/86, WASTE AGE 11/86
CAPE MAY	NJ	MB/OF	YES	300	1990	1	NA	McILVANE 5/86
FORT DIX	NJ	MI/SA	YES	80	1988	4	BH/S	CITY CURRENTS 10/86
UNION CO.(RAHWAY)	NJ	NA	YES	1500	1990	0	NA	McILVANE 5/86, WASTE AGE 11/86
HUNTERDON CO.	NJ	NA	YES	300-500	NA	0	NA	McILVANE 5/86, WASTE AGE 11/86
EDISON TOWNSHIP	NJ	NA	YES	3000	1989	1	NA	McILVANE 5/86, WASTE AGE 11/86
SUSSEX CO.(LAFAYETTE)	NJ	NA	YES	400	NA	1	NA	McILVANE 5/86, WASTE AGE 11/86
SOMERSET CO.(BRIDGEWATER)	NJ	NA	YES	600	1988	0	NA	McILVANE 5/86, WASTE AGE 11/86
MERCER CO.(HAMILTON TOWNSHIP)	NJ	NA	YES	1200	NA	0	NA	McILVANE 5/86, WASTE AGE 11/86
MORRIS COUNTY	NJ	RDF	YES	1000	NA	1	NA	WASTE TO ENERGY 9/25/85
RENO (PHASE II)	NV	RDF	YES	1000	NA	4	NA	CITY CURRENTS 10/86
HUDSON FALLS (WASHINGTON COUNTY)	NY	MB/OF	YES	400	1988	3	DS/ESP	CITY CURRENTS 10/86
ONTARIO CO.(WESTERN FINGER LAKES)	NY	MB/OF	YES	600	NA	1	NA	STATE OF NEW YORK
HUNTINGTON	NY	MB/OF	YES	750	1990	2	NA	STATE OF NEW YORK
BABYLON	NY	MB/OF	YES	750	1988	4	DS/BH	CITY CURRENTS 10/86
OYSTER BAY	NY	MB/OF	YES	1650	1989	4	ESP	McILVANE 5/86
ST. LAWRENCE COUNTY	NY	MB/OF	YES	225	1989	3	NA	CITY CURRENTS 10/86
NEW YORK (BROOKLYN NAVY YARD)	NY	MB/OF	YES	3000	1989	2	DS/BH	WASTE TO ENERGY 10/23/85
LONG BEACH	NY	MB/OF	YES	200	1988	4	ESP	STATE OF NEW YORK
NORTH HEMPSTEAD	NY	MB/OF	YES	1000	1990	2	NA	STATE OF NEW YORK
SOUTH BRONX	NY	MB/OF	YES	800	NA	3	BH/S	McILVANE 5/86
ONONDAGA COUNTY (SYRACUSE)	NY	MB/OF	YES	1400	NA	2	NA	WASTE AGE 11/86
HEMPSTEAD	NY	MB/OF	YES	2250	1989	2	DS/ESP	CITY CURRENTS 10/86

TABLE B-2. PLANNED FACILITIES ORDERED BY STATE AND DESIGN TYPE (Continued)

LOCATION				TOTAL PLANT CAPACITY				
CITY	STATE	COMBUSTOR TYPE	HEAT RECOVERY	(TPD)	STARTUP DATE	STATUS CODE	CONTROL STATUS	REFERENCES
BROOME COUNTY	NY	MB/OF	YES	500	1991	3	NA	McILVANE 5/86
DUTCHESS COUNTY	NY	MB/RC	YES	400	1987	4	BH	CITY CURRENTS 10/86
ISLIP	NY	MB/RC	YES	518	1988	4	ESP	EPA REGION IV SUBMITTAL
GREENE COUNTY	NY	MI/SA	YES	300	NA	1	NA	EPA REGION IV SUBMITTAL
ERIE COUNTY	NY	MI/SA	YES	250	NA	1	NA	EPA REGION IV SUBMITTAL
GENESEE COUNTY	NY	MI/SA	YES	100	NA	1	NA	WASTE AGE 11/86
BRONX (BARRETTO POINT)	NY	NA	YES	2000	NA	2	NA	STATE OF NEW YORK
MANHATTAN(SHERMAN CREEK)	NY	NA	YES	1200	NA	2	NA	STATE OF NEW YORK
STATEN ISLAND	NY	NA	YES	3000	NA	2	NA	STATE OF NEW YORK
QUEENS(MASPETH)	NY	NA	YES	1200	NA	2	NA	STATE OF NEW YORK
SARATOGA CO.	NY	NA	YES	360	NA	2	NA	McILVANE 5/86, WASTE AGE 11/86
MONTGOMERY COUNTY	OH	MB/OF	YES	300	1987	4	NA	CITY CURRENTS 10/86
FRANKLIN	OH	RDF	YES	150	1987	3	NA	U.S. EPA
PORTLAND	OR	MB/OF	YES	1200	1990	1	NA	McILVANE 5/86
YORK COUNTY	PA	MB/UF	YES	1000	1989	1	NA	EPA REGION III SUBMITTAL
HANOVER BOROUGH	PA	MB/OF	YES	200	NA	1	NA	EPA REGION III SUBMITTAL
CHESTER	PA	MB/OF	YES	1200	1988	3	NA	EPA REGION III SUBMITTAL
BERKS COUNTY	PA	MB/OF	YES	1200	1988	1	NA	McILVANE 5/86
MONTGOMERY COUNTY	PA	MB/OF	YES	1200	1989	4	NA	CITY CURRENTS 10/86
SOUTHWEST BUCKS	PA	MB/OF	YES	200	NA	1	NA	WASTE TO ENERGY 12/85
CENTRAL BUCKS	PA	MB/OF	YES	150	NA	1	NA	EPA REGION III SUBMITTAL
DELAWARE COUNTY (RESOURCE REC. 2)	PA	MB/OF	YES	1500	NA	1	NA	McILVANE 5/86
MIFFLIN COUNTY (LEWISTOWN)	PA	MB/OF	YES	100	NA	1	NA	McILVANE 5/86
BUCKS COUNTY (FALLS TOWNSHIP)	PA	MB/OF	YES	2200	NA	1	NA	McILVANE 5/86
MERCER COUNTY	PA	MB/OF	YES	250	NA	1	NA	WASTE TO ENERGY 10/23/85
UPPER BUCKS	PA	MB/OF	YES	200	NA	1	NA	EPA REGION III SUBMITTAL
LEHIGH VALLEY	PA	MB/OF	YES	1050	1989	3	NA	EPA REGION III SUBMITTAL
EPHRATA BOROUGH	PA	MB/OF	YES	1250	1990	1	NA	EPA REGION III SUBMITTAL
LOWER LUZERNE COUNTY	PA	MB/OF	YES	100	NA	1	NA	EPA REGION III SUBMITTAL
PHILADELPHIA (SOUTH)	PA	MB/OF	YES	2200	NA	1	NA	McILVANE 5/86
LANCASTER COUNTY	PA	MB/OF	YES	1000	1990	1	NA	EPA REGION III SUBMITTAL
MONROE COUNTY (EAST STRAUSBURG)	PA	MI/SA	YES	300	1987	1	NA	EPA REGION III SUBMITTAL
CLINTON COUNTY (LOCKHAVEN)	PA	MI/SA	YES	200	NA	1	NA	McILVANE 5/86
POTTER COUNTY	PA	MI/SA	YES	25	NA	1	NA	EPA REGION III SUBMITTAL
WESTMORELAND COUNTY	PA	MI/SA	YES	50	1986	5	NA	CITY CURRENTS 10/86
MORGANTOWN	PA	NA	YES	600-750	NA	0	NA	EPA REGION III SUBMITTAL
NORTH PENN	PA	NA	YES	200	NA	1	NA	EPA REGION III SUBMITTAL
YORK	PA	NA	YES	1000	1989	3	NA	McILVANE 5/86
ERIE	PA	RDF	YES	847	1988	2	NA	CITY CURRENTS 10/86
NORTHERN TIER SOLID WASTE AUTHORITY	PA	RDF	YES	100	NA	1	NA	CALIFORNIA WASTE MANAGEMENT SURVEY
SAN JUAN	PR	MB/RC	YES	1000	NA	1	NA	McILVANE 5/86
QUONSET INDUSTRIAL PK	RI	MB/OF	YES	710	1990	4	NA	CITY CURRENTS 10/86
JOHNSTON	RI	MB/RC	YES	710	NA	3	NA	STATE OF RHODE ISLAND
WOONSOCKET	RI	MB/RC	YES	710	NA	3	NA	STATE OF RHODE ISLAND
CHARLESTON	SC	MB/OF	YES	600	1988	3	NA	McILVANE 5/86, WASTE AGE 11/86
KNOX CO.(KNOXVILLE)	TN	NA	YES	1200	1991	1	NA	McILVANE 5/86, WASTE AGE 11/86
HOUSTON (PASADENA)	TX	MB/OF	YES	1500	1990	3	NA	WASTE AGE
AUSTIN	TX	MB/OF	YES	550	1989	3	NA	McILVANE 5/86, WASTE AGE 11/86
LUBBOCK	TX	MB/RC	YES	500	1987	3	NA	McILVANE 5/86

TABLE B-2. PLANNED FACILITIES ORDERED BY STATE AND DESIGN TYPE (Continued)

LOCATION		COMBUSTOR	HEAT	TOTAL PLANT CAPACITY	STARTUP	STATUS	CONTROL	
CITY	STATE	TYPE	RECOVERY	(TPD)	DATE	CODE	STATUS	REFERENCES
CORPUS CHRISTI	TX	NA	YES	550	NA	1	NA	McILVANE 5/86, WASTE AGE 11/86
GALVESTON	TX	NA	YES	200	1992	3	NA	McILVANE 5/86, WASTE AGE 11/86
GRAND PRAIRIE(IRVING)	TX	NA	YES	700-800	NA	1	NA	McILVANE 5/86, WASTE AGE 11/86
ALEXANDRIA/ARLINGTON	VA	MB/OF	YES	975	1987	4	NA	CITY CURRENTS 10/86
FAIRFAX COUNTY	VA	NA	YES	3000	1990	2	NA	McILVANE 5/86
PETERSBURG	VA	RDF	YES	2400	1986	4	NA	CITY CURRENTS 10/86
PORTSMOUTH	VA	RDF/C	YES	2000	1987	4	NA	CITY CURRENTS 10/86
RUTLAND	VT	MI/EA	YES	240	1987	4	ESP	CITY CURRENTS 10/86
LYNDONVILLE	VT	NA	YES	200	NA	3	NA	McILVANE 5/86, WASTE AGE 11/86
SPOKANE COUNTY	WA	MB/OF	YES	1000	1990	2	NA	McILVANE 5/86
SNOHOMISH COUNTY	WA	MB/OF	YES	1500	1992	1	NA	WASTE TO ENERGY 9/25/85
SKAGET COUNTY	WA	MB/RC	YES	150	1988	2	NA	WASTE AGE
KING COUNTY	WA	NA	YES	2000	1993	1	NA	EPA REGION X
TACOMA	WA	RDF	YES	500	1988	4	NA	FRANKLIN

KEY

COMBUSTOR TYPES:
- MI/SA = MODULAR COMBUSTOR WITH STARVED AIR
- MI/EA = MODULAR COMBUSTOR WITH EXCESS AIR (VICON)
- RDF = REFUSE DERIVED FUEL FIRED IN DEDICATED BOILER
- RDF/C = REFUSE DERIVED FUEL/COAL COFIRING
- MB/OF = MASS BURN WITH OVERFEED STOKER
- MB/RC = MASS BURN IN ROTARY COMBUSTOR
- NA = DATA NOT AVAILABLE OR TECHNOLOGY UNDECIDED

STATUS CODE:
- 0 = STATUS UNKNOWN
- 1 = EARLY PLANNING STAGES
- 2 = PERMITTING STAGES
- 3 = CONTRACT AWARDED
- 4 = CONSTRUCTION UNDERWAY OR EXPECTED SOON
- 5 = TESTING STAGES

CONTROL STATUS:
- BH = BAGHOUSE
- S = WATER SCRUBBER
- ESP = ELECTROSTATIC PRECIPITATOR
- AG = ACID GAS CONROL
- DS = DRY SCRUBBER